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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. X. NEW YORK, JULY 9, 1887. No. 2.

FROM the illustrations and account appearing on another page it will be seen that the process of welding by means of the electric arc has already entered the domain of the applied arts, and bids fair to see considerable extension. By its use what was heretofore difficult of attainment—a perfect seal in metallic vessels—is readily accomplished, and other difficult work is also easily done.

THE resolve taken by a number of the local lighting companies, as described in our recent issues, to make their own carbons, is coming to shape in definite action. At a meeting held in this city last week, a committee of six, of which Mr. J. Frank Morrison is chairman, was formed to carry out the details of a plan of organization and co-operation. This is a significant step. Will prices now be cut?

RUMORS are revived in regard to the control that the Western Union Company has been credited with securing of the Baltimore & Ohio Company, and of course the rumors are once more denied. While the latter company may not "sell out," there is no very good reason why it might not agree to a uniformity of rates. Possibly both cable and land rates may be advanced.

THE time is drawing near for the meeting of the National Electric Light Association in Boston. It is evident already that the attendance will be large—embarrassingly so in some respects—and there will undoubtedly be a great many important subjects brought up for discussion. The range of topics within the practical survey of the Association widens yearly, and it might also be said that the Association bids fair, from choice or necessity, to assume new functions, increasing at once its responsibility and its usefulness.

AT regular intervals some one is bound to discover the property possessed by iodide of mercury of turning its color from red to black when heated, and applying it to some new purpose. We believe, however, that it was nearly fifteen years ago Prof. A. M. Mayer first applied this property of the substance to indicate in a visible manner the overheating of various things. As noted in another column, the iodide is now employed to indicate a dangerous degree of heat in electric conductors, and, as such, may prove of some value, although it would be well not to depend wholly upon its indications for a knowledge of the current passing in a conductor.

THE electric meter designed by Siemens and described elsewhere, presents considerable analogy to the electric speed indicator which we described some years ago as the invention of Dr. Horn, but for which Mr. Edward Weston claims priority. In both, the currents generated in a copper shield play the part of the variable force, in the one acting as a brake and in the other is the impelling force. Both instruments being founded on the same law of action, it follows that in both the indications are independent of the strength of the magnetic field, and hence a change in magnetism of the permanent magnets has no effect upon the readings.

THE change from animal power to electricity of an entire street railway system, including fifteen miles of track, and eighteen cars, as was recently accomplished at Montgomery, Ala., is indeed an event which speaks volumes for the strong confidence that the operators of street railways already have in the capacity for work and economy of the electric locomotive. But while smaller cities are thus making rapid strides, we find the larger ones still holding off and watching the results obtained. This is but natural when we consider that many of the larger companies number their cars by the hundred and their horses by the thousand. To alter the former for electric traction and to do away with the use of the latter altogether, is an undertaking which involves considerations other than occur in smaller towns. Still with an electric railway now in course of construction in this city, and others contemplated, it is clear that the lead of the minor cities will soon be generally followed, and the horse-car be finally and wholly banished.

THE new type of battery investigaged by Dr. Alder Wright, and described in our last issue, is an interesting example of the result of inductive reasoning, and may give rise to a long series of similar forms. The only drawback to this type of battery is that which is also inherent in its prototype, the Grove cell. In both an alterable solution takes the place of an oxidizable metal; but it is apparent that for equal ampère hour capacity the former type of cell must be far more bulky than the latter. In the new type we have to oxidize one solution by the action of another, but the quantity of oxidizable material occupies more space than if it were presented in the solid form, in the shape of a metal. The hint is also thrown out that by some such method, the energy residing in coal may ultimately be applied to the production of electricity direct, and the idea is worthy of further study. We may add in this connection that we are informed that such a method has been actually reduced to practice in a voltaic battery, and that nearly the entire energy residing in the coal is converted into electric energy.

IN the discussions which have been carried on in regard to long distance distribution by means of converters and alternating currents, it has been predicted more than once that the time would come when the continuous current would be equally applicable to the same purpose, and that with it some of the difficulties met with in the employment of the alternating current would be removed. The idea of interrupting the continuous current for the purpose of obtaining a rise and fall in magnetism in the converters is not new by any means, but the obtaining of a direct current from the extra current is a novel application of this method. Again, the employment of a coil with but a single winding to take the primary current and deliver the secondary is also a new departure in this line. In the system described in another column, the secondary or extra current generated in an electro-magnetic coil is utilized as the working current. This secondary current is ordinarily of a higher potential than the primary or inducing current, but by suitably uniting a number of coils so that they discharge in parallel their potential is reduced below that of the primary which passes through the coils in series. We are not informed as to efficiency of this system. It would be interesting to know how it compares with the alternating current method with double wound converters.

THE present method of building up storage batteries consists, as is well known, in soldering all the plates of the same polarity to a common connecting piece or strip, the object of this being to avoid all joints which could be acted upon by the acid fumes of the battery. The removal of single plates from a battery is therefore impracticable, or at least accompanied with some difficulties. It seems that this circumstance principally stands in the way of the adoption of the battery for car lighting by the Pennsylvania Railroad Company. As was stated in the discussion on Mr. Blodgett's paper, what is wanted is a simple connector whereby a single plate can be removed when it shows any disposition to deteriorate. This is a direction in which inventive genius might well be called into play, for such an arrangement is equally desirable on batteries used in stationary plants, and still more so in those employed for street car propulsion. Experience has shown that lead or some other metal not attacked by the acid is alone available as a connector.

IT is evident from the manner in which the articles that have appeared in these columns, relating to the question, What is electricity? have been made the subject of discussion both in this country and abroad, that thinking men are not altogether satisfied with the theory of electricity as it stands to-day. Physicists probably know as much about electricity as about most other natural phenomena, yet while every one seems fairly well satisfied with the theories given for the latter, many seem to demand more light when electricity is defined on similar lines. Indeed, in the absolute sense in which the question is usually asked, it can virtually no more be answered than can the question, What is the attraction of gravity? Numberless theories have been propounded for the latter, and so it is with regard to electricity. Indeed, it is but natural that with the general advance in knowledge, derived from experiment, ideas formerly accepted as true should be modified or entirely swept away to make room for new ones, and we may almost say that we have arrived at such a transition stage with regard to electricity. The part which the ether will play in the new theory will be prominent, for more than one person who has essayed to answer the question recently has fallen back upon that element as a means of bridging breaks in the chain of argument.

THE electric lighting of passenger trains, a most timely topic, very properly occupied the attention of the last meeting of the American Institute of Electrical Engineers, and the paper presented by Mr. Blodgett contained much food for thought. While all those present conceded the superiority of electric illumination for this purpose, much of the discussion naturally bore directly upon the best means of carrying out the idea in actual practice. Mr. Blodgett set forth very fully the different methods proposed thus far, and from these it will be seen that, speaking generally, four modes are open, viz.: lighting by primary batteries carried on the train; secondary batteries carried on the train and charged at a terminus; secondary batteries carried on the train and charged by a dynamo carried on the axle; and finally, the system of having a separate plant in the baggage car of the train, with engine and dynamo for lighting direct. The objection raised against the last method is that the cars can receive no light when detached from the dynamo car. In all the other methods, with the exception of the first, the secondary battery must be looked to for bridging over irregularities in the working of the charging apparatus. Which of these methods is to be the final one adopted can no more be determined now than can the question as to which is the best primary battery. The question must, to a great extent, be a matter of circumstance and adaptability. On roads with very light grades, it would be out of place to put in the system of batteries and charging dynamo driven from the axle, as the benefit to be derived from the momentum of the train running down grade would not be available on such a road. For those who argue that the locomotive must not be called upon to do more work than it now performs, either in the charging of the batteries or their hauling on the cars, the solution of the problem lies in the direction of the method of a separate lighting plant on the train. It is evident, therefore, that a wide latitude is permissible for the gratification of individual tastes and the adaptation to existing conditions. So far as the results obtained in this country at the present time go, Mr. Blodgett's opinion is a valuable one. He states that storage is no dearer than gas, for the same amount of light, while further obvious improvements, both in the batteries and the lamps, will make this balance turn decidedly in favor of the electric light, even on the single ground of economy. It seems to be tolerably well established that if the storage battery can perform the duties of car lighting satisfactorily, its cost will not stand in the way of its introduction on a large number of roads in this country, especially on competing lines, which add every attraction and comfort in order to draw patronage.

NEW BOOKS.

ANNUAIRE DE L'ELECTRICITÉ. 1887. By A. Révérend. Paris. 1887. Bernard Tignol. 360 pp.

This volume is a complete directory of electricians, electrical manufacturers, societies, etc., in France and Belgium, and gives in addition much statistical information relative to the companies engaged in electrical work. The book also contains an electrical directory of all the other European countries, including Great Britain. The classification observed is very good, so that reference is made easy.

MAGNETO AND DYNAMO ELECTRIC MACHINES, WITH A DESCRIPTION OF ELECTRIC ACCUMULATORS. Translated from the German of Glaser de Cew, by F. Krohn. Second Edition, enlarged; with a preface and additional chapter on the latest types of machine. By W. B. Esson. London: Whittaker & Co. 1887. 5¼ × 7¼. 311 pp. Price, $3.00.

This book, which is already well known, has received careful revision and its value has, therefore, been greatly enhanced. Especially is this the case in the description of the most modern machines. This latter work, as well as the revision, has been undertaken by Mr. W. B. Esson, whose name is well known in England. These additions, relating to the latest practice, when read in conjunction with descriptions of the work of but a few years ago, will give the student an excellent idea of the direction in which progress has been made and the rules which have been followed in securing the desired ends. We would only remark in adverse criticism that several bad typographical errors, one even on the title page, might have been avoided with a little care in proof-reading.

A Novel Current Indicator.

The chemical, iodide of mercury, has the well known property of changing from red to a dark brown or black when heated, and this property has been taken advantage of by Mr. Henry Crookes in the construction of a novel indicator for giving warning when an excess of current is passing in a circuit. The instrument consists essentially of a flat coil of thin wire painted with this heat indicating paint, and a screen round it, coated with ordinary red paint of the same shade. Coils of thick wire are placed in parallel circuit with the thin wire, and their resistances are so adjusted that by setting a commutator, the point at which the indication of an excess of current takes place can be varied to suit different requirements. When an electric current is passed through the instrument the thin wire becomes warm, and when the current exceeds a certain quantity the temperature is raised sufficiently to change the color of the paint to black, thus warning the man in charge that an excess of current is passing. On the current being reduced, the temperature of the coil fails, and the paint returns to its original red color. It will be seen from this that Mr. Crookes considers the instrument likely to be of use where a constant current has to be maintained in the circuit.

The Efficiency of Electric Motors.

BY W. FORMAN COLLINS.

With reference to the article on the "Efficiency of Electric Motors" in THE WORLD of July 2, I should like to point out that w, the electrical energy taken up by the motor, will not be a maximum when $e = E$. The important point with regard to a motor is not so much to make e, the counter E. M. F., nearly equal E, the E. M. F. delivered by the generator, as to run at such a speed that w is a maximum, for then the mechanical efficiency will be a maximum.

To find the ratio of e to E to make w a maximum, differentiate w with respect to e and equate to zero.

$$\frac{d\,w}{d\,e} = \frac{d\left(\frac{e\,E}{R} - \frac{e^2}{R}\right)}{d\,e} = 0$$

$$\frac{E}{R} - \frac{2\,e}{R} = 0;$$

$$\frac{E}{R} = \frac{2\,e}{R}$$

$$e = \frac{E}{2}$$

Therefore, to get w a maximum, e must equal $\frac{1}{2}E$ and the electrical efficiency will then be 50 per cent.

The ratio

$$\frac{w}{W} = \frac{e}{E} = \frac{\text{electrical energy taken up by the motor}}{\text{electrical energy supplied}},$$

represents the electrical efficiency of the motor.

The mechanical efficiency would be as follows:

Put a brake on the pulley of motor and let the reading be w_1 watts. Then $w - w_1 =$ loss by friction, etc., in the motor; ∴ mechanical efficiency $= \frac{w_1}{W}$.

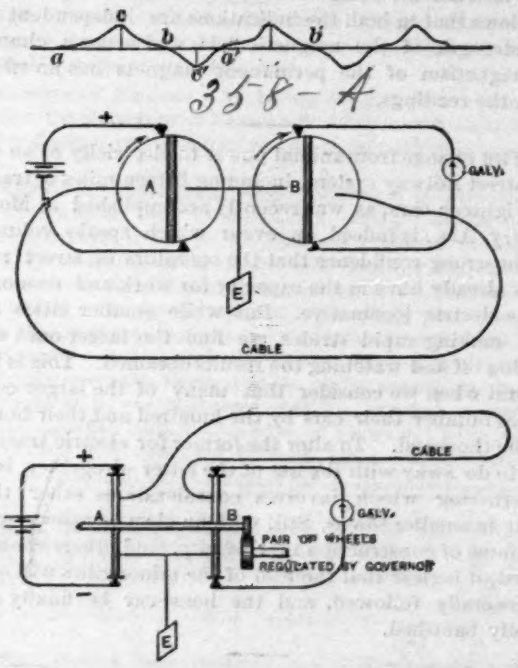
Now the greater w is, the higher will be the mechanical efficiency.

If e were very much smaller than $\frac{E}{2}$, w would be very small. Of course the higher the difference of potential E used, the greater is the efficiency of the transmission, but the line must be more carefully insulated to guard against leakage, which will be greater with higher potential. The same conditions in building an efficient generator must be followed in constructing an efficient motor. With every value of w there will be two values of current except the maximum. For the best effect, select that current which gives greatest counter E. M. F., which is the lowest current.

On Time Constants.*

BY W. H. PREECE, F. R. S.

In the year 1862 Mr. Cromwell Varley described to the Royal Society (Proc. R. S., June 19th) one of the most beautiful instruments ever devised for the purpose of measuring the retardation of currents. It is known as the "wave bisector," and it was with this instrument that Mr. Varley verified Sir W. Thompson's law of the speed of working cables. It is because it is so admirably adapted to measure the time constant of electro-magnets, and to deduce therefrom the coefficient of self induction, that I venture to recall it to mind now that self induction has become so much the fashion among electricians. It is quite amusing to an old stager like myself to see how every technical journal in France and Germany teems with methods to determine the value of L. It recalls to my memory the fact that one of the first experiments in which I took part with Mr. Latimer Clark was in 1853, when the then Astronomer Royal (Sir George Airy) determined the time constant of the relays ("peckers" we called them) he used when determining the difference of longtitude between Greenwich and Brussels. We arranged a series of relays like a cascade, so that they were actuated by each other in succession, and we added to the series until exactly one second elapsed between the making of the circuit and the completion of the last signal. It required thirteen relays to do this, and therefore the time constant of each relay was one-thirteenth of a second—rather a contrast to the relays of the present day, which have a time constant of one five-hundredth and less. This was an experiment that would be difficult to repeat at the present time. The term "time constant" was introduced by Lord Rayleigh (then Mr. Strutt), in a paper in the *Philosophical Magazine* for July, 1869—a paper that developed nearly all we now know about self induction. Maxwell's book was not then published, and his scattered papers, in which he solved electrical problems by reference to their analogues in ordinary mechanics, were difficult to get. Lord Rayleigh showed how the effect of self induction was like the action of the hydraulic ram, and partook, therefore, of the character of inertia. Sparking is the bursting of a pipe. Condensers stop sparking as the air chamber prevents pipe bursting. The motion of a current is opposed by a force of the nature of friction. "There is for every conducting circuit a certain time constant which determines the rapidity of the rise or fall of currents and which is proportional to the self induction and conductivity of the circuit. Thus, to use Maxwell's notation, if L and R be respectively the coefficient of self induction and the resistance, the time constant is $\frac{L}{R} = \tau$."



FIGS. 1, 2 AND 3.—STUDY OF TIME CONSTANTS.

The only instrument in telegraphy in which self induction, or (as I much prefer to call it) electro magnetic inertia, is injurious is the receiver of a Wheatstone automatic apparatus. A knowledge of the time constant of such an instrument was of consequence, but the baneful effects of self induction have now been entirely eliminated by the use of shunted condensers. The number of dots made at its maximum speed gives the time constant of a Wheatstone receiver, or of a relay if it actuate a Bain receiver; but the time constant of telegraphic apparatus has ceased to have any consequence.

The following description of Varley's wave bisector was written by me in the year 1869, and I give it verbatim. The diagrams, Figs. 1, 2 and 3, are merely symbolical representations of the apparatus. The two wheels A and B rotate together on the same spindle. When the connections on one (A) are reversed, those on the other (B) are reversed at the same moment. Thus, if there be no retardation, the current through the galvanometer preserves the same direction, for when the current is reversed at A its direction through the galvanometer is also reversed by B. Its strength is constant for the same velocity of rotation. But if there be retardation, then the reversals will not be simultaneous as regards the current. There is a succession of positive and negative currents of equal duration sent by A. Their arrival at the distant end may be graphically represented thus: $a\,b$ is the length of the current or the time during which it flows, and c is its maximum strength. Now if the connections at B are reversed at the moment when the arrival current there has attained its maximum strength c the wave $a\,b$ is bisected—one half of it, $a\,c$, flows through the galvanometer in one direction, and the other half $c\,b$ in the other direction. The result is zero on the galvanometer if it have sufficient inertia to remain steady, for these two halves are equal. The same occurs with each wave, positive or negative, and therefore the needle remains at zero. This point is attained when the wheel is a quarter revolution in advance of the wave.

Other zeros are attained when the speed is still further increased—that is, when the wave is half a revolution, three-quarters of a revolution, etc., behind. Now the length of the wave $a\,b$ is measured by the period of the revolution of the wheel or the duration of the contact at A, and it depends upon the retardation in the cable. It is very evident that the greater the retardation of the cable, the longer must be the wave, and therefore the slower must be this rate of rotation to mete out the waves. Thus the number of reversals per minute or per unit of time is an accurate measure of the relative retardation of the wires or instruments examined. The greater the number of reversals per unit of time, the greater the speed of working of the cable, the less the retardation, and therefore the less the time constant. The duration of the contact on A determines the length of the wave $a\,b$; the retardation of the wire determines the rate of rotation of the wheel, and this determines the form of the curve, or the strength of the received current c.

It is advisable always to take the first zero and to commence with a low velocity until the proper speed is attained. If this is not done the second zero may be mistaken for the first, and errors introduced.

We cannot by its means measure the absolute velocity of the current, but we can tell the time required to produce a wave of sufficient strength to actuate the instrument we employ. Thus if we find that we obtain a zero with ten reversals per second, the time constant $a\,c$ is one-fortieth of a second, and if our wire were 500 miles long the velocity of a wave of such a strength would be 20,000 miles per second. In some experiments on cable lines the velocity attained was 6,750 miles per second with No. 4 wire, and 4,860 miles per second with No. 8, showing the influence of resistance on speed. Hence the great discrepancy observed in measuring the velocity of electricity. It is not so much the velocity of the current that has been measured, but the sensitiveness of the instrument employed to register the currents of a definite strength.

* Industries.

The Civil Engineers and the Electrical Engineers.

The American Society of Civil Engineers held its annual meeting during the past week at the Hotel Kaaterskill, in the Catskill Mountains. About 300 members and friends were in attendance, and the meeting was one of the most successful ever held by the society. The President, Mr. Wm. Worthen, in his annual address, quoted a number of statistics to show the growing extent and importance of electrical work, and called attention to the sister society, the American Institute of Electrical Engineers. On Monday last, stimulated by, and seconding, the movement recently set on foot by the Institute to secure permanent quarters, the society, in whose comfortable house in East Twenty-third street the Institute has gathered from time to time since its foundation in 1884, considered the pressing subject of larger accommodation, and the result was that nearly $5,000 was contributed on the spot to a fund, the object of which is either to enlarge the present house or to secure new property. The fund, like that of the Institute, is still growing steadily, and the prospects are that the joint action now being taken will soon give both bodies a home equal to their necessities.

Speaking of the effort made by the Institute, the *Iron Trade Review* says:

The American Institute of Electrical Engineers, an organizat on little more than three years old, is making commendable efforts to purchase a building in New York City to contain an electrical library, a museum of electrical apparatus and models, and an experimental laboratory. The work of the Institute is of a national character, and is deserving of national support. In this day of enlightment too much encouragement cannot be shown a cause to which the world is indebted for the most important inventions. The knowledge of electricity is avowedly in its infancy as yet, and all that is possible should be done to disseminate the spark and fan it into flame.

Working Metals by Electricity.

In a recent issue we described the process of working metals by the heat generated in the electric arc according to the method of M. de Benardoz, and we are now able to give some more of the details of the process as described by M. J. Sarcia in *La Lumière Electrique*.

For soldering or welding two metals, a cast-iron plate mounted on an insulated table is employed. This "electric anvil," as it is called, is permanently connected with the negative pole of the source of current, the E M. F. of which must, of course, be greater than the counter E. M. F. developed in the arc employed. The pieces to be welded are placed upon this anvil in the most convenient position, and are thus automatically put in contact with the negative pole.

The positive pole of the source of current is connected to an electric light carbon by means of a flexible conductor. The carbon is held in an insulating handle, which the workman holds in his right hand. This tool is shown in Fig. 1 of the accompanying illustrations. Fig. 2 represents the electric welding shop at La Chapelle, showing a workman in the act of welding a sheet-iron cylinder.

In applying the carbon point to the part to be welded, the workman closes the electric circuit, and then, raising the carbon a short distance, starts the voltaic arc which causes the fusion of the metals. He then carries the arc forward by hand, along the length of the junction of the two metals and thus welds or solders them completely.

During the operation the workman protects his eyes from the glare of the arc by means of colored or smoked glasses mounted in a mask, or in a screen, Fig. 3, which he holds in his left hand.

It is obvious that the strength of the current varies with the nature of the work to be done. In practice, in order to maintain a continuous and regular working of the dynamo which furnishes the current, the machine is employed in continuously charging a battery of accumulators. By combining a suitable number of the latter, the requisite strength of current is obtained for the different purposes required.

This process can not only be employed in welding metals but can also be used for piercing or drilling, and cutting. By placing together two metals that have previously been pierced by the arc, they can be riveted together by passing a pin through the holes and fusing its ends.

The most important application thus far of this process is in the manufacture of metal tanks and casks, as it permits of a perfect air-tight joint being obtained. Great difficulties have heretofore been met with in obtaining casks sufficiently tight for transporting the light oils and bisulphide of carbon.

The manufacture of casks is carried on by M. Legrand, who has largely developed this industry, and who is very well satisfied with the electric process. The same gentleman is engaged in the manufacture of iron garden furniture, which is rendered very easy by the use of the electric

FIG. 1.

process. The latter can also be applied to the welding of iron and copper tubes and the attaching of the rail saddles to metal cross-ties on railroads.

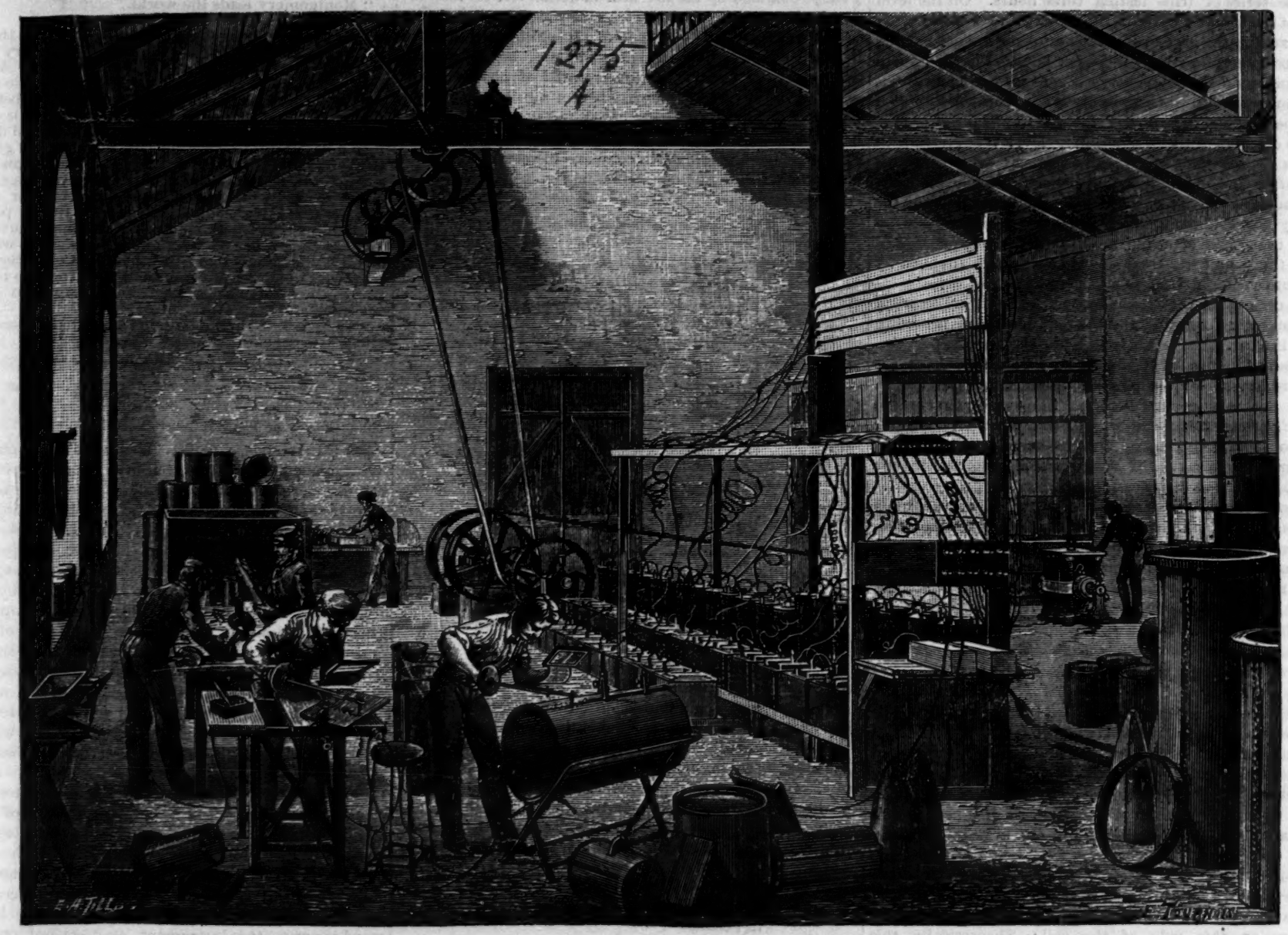


FIG. 2.—WELDING BY MEANS OF THE VOLTAIC ARC.

Magnetism and Gravitation.

In a letter addressed to the London *Electrician* Mr. Richard C. Shettle writes as follows:

My attention has been called to the *Chemical News* of June 3, which contains a paper read by Prof. Crookes at the meeting of the Royal Society, on June 1.

In his paper Mr. Crookes criticised a paper published in the *Scientific Journal* of Dax, by M. Thore, and attempted to explain, but ineffectually as he admits, the rotations of M. Thore's cylinders as owing to the influence of radiant heat.

As I have been conducting a series of experiments during the last 18 months of a somewhat similar character

FIG. 3.

and have rotated a copper and other spheres under the influence of a single magnetic pole, I shall be obliged by your finding me space in *The Electrician* for the publication of my experiments; more especially as I found that when a copper sphere was suspended and acted upon by a magnetic pole *the approach of the human body alone* was productive of a certain degree of axial rotation in the suspended sphere.

At the recent *conversazione* of the Royal Society, held on May 11, I exhibited the axial rotation of a copper sphere as described above, but without showing the influence which the human body exerted upon the movements. I believe this and similar experiments which prove the cause of the rotation, sweep away the theory that magnetism is nothing more than a definite molecular polarization, and demonstrate the existence of a current force, for without such a force the slow continuous rotation of the sphere could not be obtained. I obtained the phenomenon of the rotation of the sphere as described above by a careful study of magnetism which I was induced to make owing to some physiological investigations in which I had been engaged for many years past into the nature of the force by which animal life is sustained. For instance, I arrived at the conclusion that some physical differences existed between the arterial and venous states of the blood, which, if their full significance could be detected, would prove the nature of the vital force.

Having regard to the presence of iron in the blood of almost all animals, and to the important office it appears to fulfill, I was led to investigate the magnetic differences of the arterial and venous blood. I then proved experimentally* that the arterial blood is paramagnetic to the same blood in the venous state. But I had no sooner completed these investigations than I found they would be of little service unless the character of the magnetic force could be more clearly defined than it then was; I therefore continued my researches by making a careful investigation into the nature of magnetism.

My first experiments were conducted upon bar magnets, and I then established the fact that the equator and axis of a bar-magnet are always oblique.† This led to the inference that the same cause for obliquity existed in the bars as in terrestrial magnetism. By a second series of experiments on bar magnets, on which a paper was read at the Physical Society of London, and subsequently published in *The Electrician*, the seat of polarity near the end of a bar magnet was found to change when two poles of the same sign were placed together, and to move to the line of contact.

My more recent investigations have been into the nature and cause of terrestrial magnetism, and I believe I have now determined the relations which subsist between magnetic force and gravitation, and further, I am able to prove that the motion of the celestial bodies, as well as the movements which germinal matter undergoes in the process of being converted into animal or vegetable cells are equally under the influence of this force; and that

* Vide *Proceedings* of Royal Society, 157, 1875.
† *Ibid*, 1879.

the character of their motions, of their axial inclination, and of their orbits is determined by the description of resistance which the material unit, whether large or small, offers to the all-pervading current force.

Electrical Street Cars in Philadelphia.

Experiments with electricity as a motive power for street cars have been carried on for some time by William Wharton, Jr., & Co., of Philadelphia, and the results obtained were shown last week in a public demonstration.

The line has been put down in the yards of Messrs. Wharton, Jr., & Co.'s premises, and it forms an almost rectangular track which measures 1,050 feet. There are four curves along this line, the sharpest of which has a radius of 33 feet, and with this curve commences a gradient of 5 feet in one hundred, or 264 feet to the mile.

Ordinarily each round trip takes 1 minute and 30 seconds, but the straight portions of the line are so short that full speed is not permissible owing to the frequency of these sharp curves; but a trip has been made in 70 seconds over these 1,050 feet of track.

There are 84 small accumulators on the car, under the usual seats. The capacity of each cell is 150 ampère hours, and about 120 ampère hours are withdrawn in the course of one series of trips lasting three hours. On the level part of the tracks a current of from 25 to 30 ampères is used, and up the grade 95 to 105 ampères are used at the average speed of about 7¼ miles per hour. Running down the incline no electric energy is consumed. The car not only mounts that incline easily when completely filled with people, but it stops and starts at any point.

It is calculated that on a fairly level road, and with curves at reasonable intervals, this car would run for about five consecutive hours, at the end of which time the accumulators of the car will have to be exchanged for freshly charged ones, which operation need not occupy more than two or three minutes. A charging rate of about thirty ampères is employed; current is supplied by a shunt dynamo driven by a gas engine.

The cells are of the type manufactured by the Electrical Accumulator Company, and the Sprague motor is used to drive the car. The latter is also illuminated by four incandescent lamps of 16 c. p. each, and the current for these is derived from the cells which drive the motor. There are two electric bells on the car, one to call the driver's or conductor's attention, and another, a larger one, to warn passengers on the road or vehicles in front of the car. The direction of motion is reversible, and the car runs backward as easily as forward.

Several cars are now being constructed at the same works, some of which will be worked by overhead conductors, in order to test the economy, convenience and general or particular applicability of each.

All these experiments are under the charge of Mr. Anthony Reckenzaun, of London, and Mr. Herbert Condict, of San Francisco, Cal.

The Meserole Secondary Battery.

The stored up energy in the Planté secondary battery is supposed to be fixed in the layers of electrolytic lead and peroxide of lead, formed respectively on the positive and negative electrodes. The spongy electrolytic lead, when the cell is charged, has occluded a large volume of hydrogen gas. Chemically prepared spongy lead and peroxide of lead, applied to lead electrodes forming a simple electrolytic cell, would give a very weak current indeed, compared with the electrolytically formed materials. Hence, it is usual in lead secondary cells to provide an excess of spongy lead by having a larger plate surface on this pole of the cell. Theoretically this excess should not be necessary to satisfy the affinity of the peroxide pole. In practice there appears to be a loss of energy within the layer of spongy lead by local chemical action or conversion into heat, and hence a considerable fall in E. M. F. is often noticed. In experimenting with electrolytically formed layers of various metals and alloys, Mr. A. V. Meserole, of this city, has found that an electrolytic sponge composed largely of mercury and zinc with some lead, would form an effective and convenient electrode for the occlusion of hydrogen, and in combination with a plate of peroxidized lead a very efficient secondary battery. A cell formed in this way will, he claims, absorb and give out the applied current with very little loss. The E. M. F. is also high, rising from two and one-half to nearly three volts when the charging current is flowing through the cell. A given volume of the electrolytically-formed compound of mercury with zinc and lead will satisfy the affinity of a much larger mass of peroxide of lead. Experiment has shown that, when properly prepared, the cell will retain its charge for a long time or may be rapidly discharged with little loss of energy.

It might appear at first sight that this secondary battery is identical with the usual zinc-lead accumulator. The experiments of Mr. Meserole, however, have shown, that by using the same material differently combined and formed, a radical difference in results is obtained. In a lead-lead accumulator we have spongy lead and peroxide of lead electrolytically formed and charged with condensed gases. A primary electrolytic cell with electrodes coated with chemically prepared spongy lead and peroxide of lead would give a very different E. M. F. In Mr. Meserole's cell the electrolytically formed and combined spongy alloy of zinc, lead and mercury acts very differently from a solid plate of amalgamated metal opposed to a solid metal electrode of opposing polarity.

Siemens' New Electricity Meter.

The accompanying illustrations, for which we are indebted to *Industries*, show a new coulomb meter, recently invented by Dr. Werner Siemens. Fig. 1 shows a diagrammatic section through the meter; Fig. 2 represents

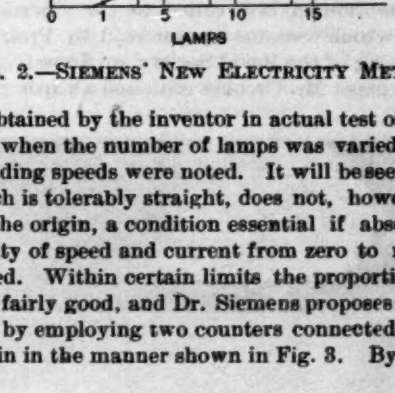


FIG. 2.—SIEMENS' NEW ELECTRICITY METER.

a curve obtained by the inventor in actual test of this instrument when the number of lamps was varied, and the corresponding speeds were noted. It will be seen that the line, which is tolerably straight, does not, however, pass through the origin, a condition essential if absolute proportionality of speed and current from zero to maximum be required. Within certain limits the proportionality is, however, fairly good, and Dr. Siemens proposes to extend the range by employing two counters connected as shunts to the main in the manner shown in Fig. 3. By means of

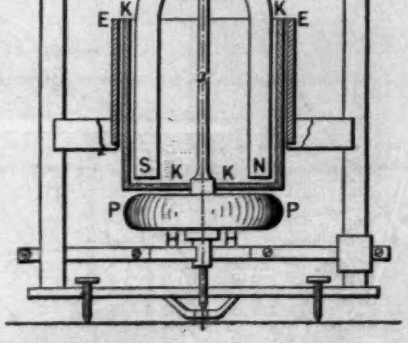


FIG. 1.—SIEMENS' NEW ELECTRICITY METER.

an electro-magnet and spring the movable contact *C*, connected at *c* to the main, is shifted either to 1 or 2, in accordance with the quantity of current passing through the main, and thus either one or the other of the two counters I. and II., connected to the main at the points *a* and *b*, is placed in circuit, but never both at the same time. One of these counters is calibrated for small and the other for large currents, and by adding their indications, the total quantity of electricity which has passed through the circuit in a given time is ascertained. The

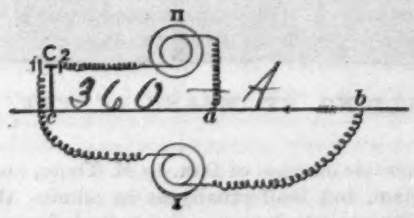


FIG. 3.—SIEMENS' NEW ELECTRICITY METER.

counter consists of a small magneto machine, and in so far it is identical with the apparatus shown by the late Sir William Siemens at the Paris Exhibition of 1881; but there is this important difference, that whereas in that instrument the rotation of the armature was impeded by the friction of an oil brake, which was naturally variable, and led to erroneous results, the present apparatus contains what may be called an electromagnetic brake, the action of which is far more reliable and not so subject to variations. A Gramme ring *P* is mounted upon a vertical spindle *x*, the top of which passes through the yoke of a permanent steel magnet, and is provided with a screw engaging with the first of a train of wheels *c*, which record the total number of revolutions on suitable dials. The current is led to the armature by means of the brushes *H H*, and motion ensues under the influence of the poles *S N* of the horseshoe magnet. To the armature spindle is firmly attached a cylindrical copper vessel *K*, and this is surrounded by a stationary iron shield *E*. It will be seen that if the armature rotates, the copper cylinder also rotates, the metal cutting the lines of force which flow from the poles to the core of the armature, and from the limbs of the magnet to the iron shield. In consequence of this, eddy currents are generated in the copper and the motion is retarded, the braking power increasing with the speed, while the latter again increases with the current passing through the armature. By setting the magnet at different angles to the line of commutation, the instrument is calibrated to give higher or lower readings. The inventor claims that a variation in the strength of the field magnet has no influence on the accuracy of calibration, both the propelling and the retarding power being influenced in the same ratio. The counter is intended to be placed as a shunt to a short piece of one of the mains, and it can also be calibrated by a suitable selection of resistance in the shunted circuits.

Fifteen Miles of Electric Railway at Montgomery, Ala.

We give below an article from the Montgomery, Ala., *Advertiser* of June 23, with regard to the Van Depoele electric railway recently started there. The Southern city may well be proud of the enterprise its street railway men have shown, and we readily forgive our contemporary its jubilant outburst of delight.

"Not a single street car mule in Montgomery.

"Fifteen miles of street railway are operated by electric power.

"Montgomery leads the world.

"Good-by, mules. Good-by, Texas.

"Yesterday all the mule-cars were taken off the fifteen miles of street railway in Montgomery and every line was operated exclusively with the electric cars. As if conscious that they had supplanted the festive mule for good and for all, the cars ran about twice as fast as before and made schedule time. The speed now as a rule is equal to that of a dummy, and the cars go up hill and down hill with a delightful unconsciousness of change in grades.

"The electric cars are a success. One motor can pull several cars, which is a vast advantage over a mule. Yesterday a car with fifteen horse-power motor had two summer cars attached, and pulled them full of people out to Highland Park without diminishing the ordinary speed.

"It is all a grand and glorious success. The whole system, the four lines, come together on Court Square and go down Commerce street on a double track to the depot. There is no halting at switches, but the cars go down on one track and back on the other.

"The whole system represents an actual expenditure of $175,000 in cash."

Wheatstone and the Word Telephone.

To the Editor of The Electrical World:

SIR: In response to Mr. Lockwood's complaint that Wheatstone did not himself use the word *telephone*, permit me to refer him to p. 295 of the little volume of Abridgements of Specifications (British) relating to electricity and magnetism, Part II. (publ. London, 1874), where he will find in the abstract of specification No. 2462, dated October 10, 1860, the following: "6th. Telephones in which 'musical pipes or free tongues' are acted upon by wind. Compressed air or gas is admitted to the pipe by means of a valve acted upon by the magnetized needle of an electro-magnet." This apparatus was to signal Morse code by alternate emission of two sounds, instead of dot and dash. This is a very different thing, obviously, from "the telephone" produced just one year later, which had neither musical pipe nor free tongue, but had instead a diaphragm and a metallic loose-contact apparatus in it, and which according to the inventor was to "take cognizance of the total vibrations of all the simultaneously operating organs of speech," which was "to communicate the very tones of speech direct to a distance," and with which "the consonants were for the most part tolerably distinctly reproduced, but the vowels not yet in an equal degree." But, as Mr. Lockwood is aware, this instrument, so described on Oct. 24, 1861, by its inventor, was discovered, not by Sir Charles Wheatstone, but by Philipp Reis. The Wheatstone instrument was not, in fact, for transmitting sound at all. Morse code signals, transmitted by a key worked by hand, were to be rendered audible by this curious sounder; that was all. From such a device to the Reis telephone is as great a leap of inventive genius as from the printing press to the photographic camera. One reproduces only the symbols artificially conveyed into its mechanism; the object of the other is to take cognizance of the scene presented to it, however complex, and to reproduce it. That is, indeed, translated into other language, the whole difference between a telegraph and a telephone.

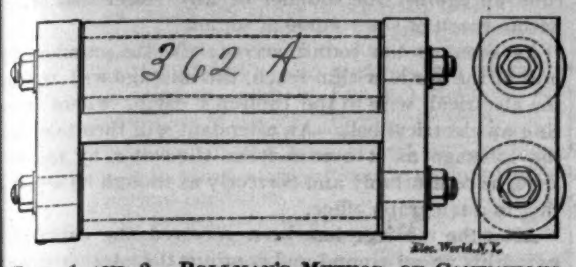
SILVANUS P. THOMPSON.

CITY AND GUILDS TECHNICAL COLLEGE,
Finsbury, London, June, 1887.

Ball Engines for Electric Lighting.—The Connecticut Electric Company, of Waterbury, Conn., have just ordered four 12 × 12 Ball engines, two of which are to be used in Waterbury and two in Poughkeepsie. The Boulder Electric Light Company, of Boulder, Col., are increasing their plant, and have ordered a 13 × 12 Ball engine. The Thomson-Houston Electric Light Company, of Atlanta, Ga., have determined to double their capacity, and to that end have just ordered an 80 horse-power steam plant complete from the Ball Engine Company, of Erie, Pa. The Brush Electric Company, of Cleveland, are enlarging their plant at Geneva, N. Y., and have given the contract for the steam plant to the Ball Company. The Thomson-Houston Electric Company, of Chicago, have just ordered an 80 horse-power steam plant complete from the Ball Company.

Bollmann's Method of Transforming Continuous Currents of High Tension into Continuous Currents of Low Tension.

The method at present adopted in general practice for converting currents from high to low tension consists in the employment of an alternating current. But there are still at work those who look to the utilization of the continuous current as feasible. One of the most recent methods proposed here for this purpose is that of Louis Bolmann, of Vienna, Austria, which presents several interesting features. In general terms, the system consists of a combination of electro-magnets with a commutator, which divides the several coils of the magnets into two



FIGS. 1 AND 2.—BOLLMAN'S METHOD OF CONTINUOUS CURRENT TRANSFORMATION.

separate circuits. One of these circuits conveys the primary current of high tension to a number of the coils joined in series, while the other circuit is connected with the remaining coils joined in parallel. The primary current passes, therefore, through the coils in its circuit from one to the other in the series, and thereby magnetizes and demagnetizes the iron intermittently, while the secondary or extra current induced in the coils of the same magnets passes off from each coil in parallel into the secondary circuit, which is therefore of low tension. The arrangement is such that both the primary and secondary currents flow successively in each coil, but always in the same direction.

The accompanying illustrations show the manner in which this is carried out. Figs. 1 and 2 show a form of coil adopted by Mr. Bollmann which, it will be observed, is of the closed magnetic circuit type. The commutator above referred to is shown in elevation and plan in Figs. 3 and 4, and is constructed with four metal rings E^{I} E^{II} E^{III} E^{IV} fastened to the shaft, but insulated therefrom. L L are the brushes and F^{I} F^{II} are drums of wood, to which the metal ring-sections G^{I} G^{II} H^{I} H^{II} J^{I} J^{II} J^{III} J^{IV} are fastened. The mutual arrangement of these sections is shown in Fig. 7, showing the circumference of the same from S to t, stretched out flat. Against this circumference bear sixteen brushes K, which are distributed around the circle in eight pairs, as is shown in Fig. 3. Fig. 7 shows the situations of the bearing surfaces of these brushes. The short parts G^{I} G^{II}, Fig. 7, (of which in Figs. 3 and 4 only G^{I} seen), are each connected with one of the rings E^{I} and E^{II} by means of copper wires l, which are insulated and pass between the shaft and the inner rings, E^{II} and E^{III}, as is seen on the left side of Fig. 4.

The segments H^{I} H^{II}, which form the larger part of the circumference, are similarly connected by pieces H^{III} to the inner rings E^{II} and E^{III}, and the plates L, bearing on these rings, are in connection with the cables forming the secondary circuit, and which lead the induced low-tension current from the ring E^{III} through its spring-plates L to the lamps and return the same again to ring E^{II}. In the same manner the two outside rings E^{I} and E^{IV} are con-

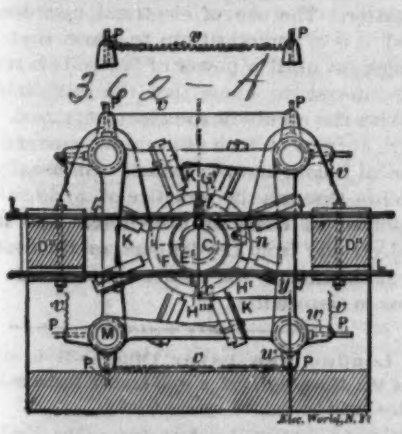


FIG. 3.

nected by their plates L, so that the current entering at E^{I} will pass through G^{I} and thence to G^{II}, and from it through E^{IV}.

The four narrow segments J^{I} J^{II} J^{III} J^{IV}, Fig. 7, are in pairs, connected by copper rods n n, passing below from one to the other, J^{I} and J^{III} forming one pair and J^{II} and J^{IV} the other. The spaces between the segments are filled out with insulating material.

Each brush-holder is connected by a flexible cable, as indicated by P in Fig. 3, to one end of the coils of the magnets. Those situated on the drum F are marked with the sign —. In the brushes marked + the currents pass from the commutator to the brush, and vice versa in those marked with —.

In Fig. 3 are shown eight cables. All brushes and cables shown are of + sign, according to the diagrams Figs. 5 and 6, while those situated behind, and therefore covered by them, are of the — sign. In Fig. 4 all brushes and cables on the right side are of the + sign, and those at the left side are of the — sign.

The connections of the coils of the magnets are illustrated in the diagram Fig. 5, in which the circumference of the commutator and the bearing surfaces of the brushes are drawn narrower than in Fig. 7.

In the diagram Fig. 6 the segment J^{I}, which is in connection with the principal current, bears on the brush marked $a+$, and this is connected by a wire to the coils of the magnet-rod, also marked $a+$. The latter coils are connected to the coils of the rod $a-$, which again is connected to the brush $a-$, that bears on the segment J^{III}. In like manner the brush $b+$ is connected with coils $b+$, and this with the coils $b-$, which again is connected with the brush $b-$, resting on the segment J^{IV}, and so are each following pair of brushes connected with the rods marked with the same letters.

It is to be remarked that the two magnet rods having similar letters (as $a+$, $a-$, $b+$, $b-$, etc.) do not belong to one ring-magnet, but to two different ones standing side by side, and that the connections of the coils are such that the currents must flow in each succeeding one in the opposite direction, so that when all would be equally magnetized no free magnetism would appear anywhere.

Let us suppose the commutator to rotate so that the circumference is moving in the direction of the arrow. The principal current is supposed to flow through l' toward the segment G^{I} and to pass to brush $a+$, then to the coils of $a+$ and $a-$ back to the brush $a-$ and segment J^{III}. From there it is passed over to the segment J^{I} (through the rod n below the surface), whence it again flows through brush $b+$, coils $b+$, $b-$, brush $b-$, to segment J^{IV}. Then again through the rod n to segment J^{II}, from where it circulates through brush $c+$, coils $c+$, $c-$, brush $c-$, to the segment G^{II}, from which it passes away to the principal cable through l''. The principal current flows, therefore, through the coils $a+$, $a-$, $b+$, $b-$, $c+$, $c-$, and magnetizes the rods to the required degree. As the commutator moves on, the segments change positions in relation to the brushes, so that, for example, in the position shown by the diagram, Fig. 6, the segments G^{I}, G^{II} are nearly leaving the brushes $a+$ and $c-$ while they are already covered by those $b+$ and $d-$, so that the principal current is never interrupted. In going on farther the segments G^{I}, G^{II} will come into the same positions in relation to the brushes $b+$ and $d-$, as they were before to $a+$ and $c-$, and the latter ($a+$ and $c-$) will have passed out of contact with the principal circuit and come into contact with the long segments H^{I} H^{II}, which are connected by the parts H^{III} with the secondary circuit. Thus the brushes to the right of segment G^{II} again come in connection with the principal circuit, and the magnets belonging to them are newly magnetized, so long until they get to the left side of G^{I} when they come out of connection with the primary and into contact with the secondary circuit again. The bars $h+$, $h-$ were thus previously magnetized, and are now demagnetized, which causes the generation of a secondary current in the coils surrounding them to be of similar direction with the principal current that has magnetized the iron. This secondary current flows over through the brush $h-$ to the segment H^{II}, and then through H^{III} into the cable leading to the lamps, returning then through H to complete the circuit, and, as the commutator rotates farther, new brushes come from the principal into the secondary circuit, so that in the arrangement illustrated there are constantly six of the magnet-rods connected with the primary and ten of them with the secondary circuit; but while the first mentioned six coils are connected with each other in series, the latter ten are connected with the secondary circuit in parallel. The magnetization consequently takes place while three pairs of coils are connected in series, and the demagnetization while five pairs of coils are united in parallel.

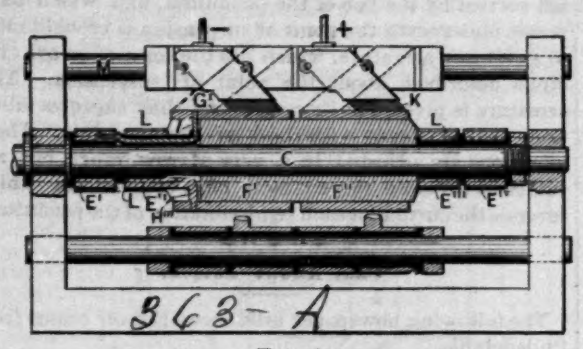
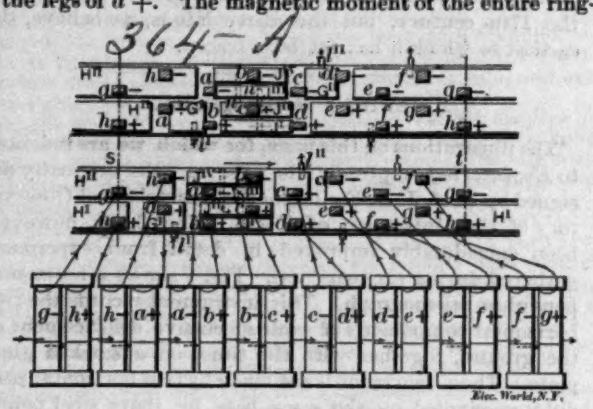


FIG. 4.

If the resistance of one pair of coils is r, then that of three pair in series is equal to $3r$, and that of five pairs in parallel is $\frac{r}{5}$. The difference of both resistances is therefore as $3r$ to $\frac{r}{5}$, or as one to fifteen, and this causes the tension of the current induced to be much less than that of the primary. It is obvious that the quantity or intensity of the current induced is in inverse proportion to its electromotive force.

At the instant when the segments G^{I} G^{II} leave a brush, the current tends to flow on, while the iron is beginning to be demagnetized. This is liable to produce intense sparks, and this would be especially the case if the coils were connected to one pair of brushes, for example, if $a+$ and $a-$, belonged to the same closed-ring magnet; but as the rods $a+$ and $a-$ belong each to another ring-magnet, the sparks are very much reduced, for the rod $h-$, belonging to the same ring-magnet to which belongs $a+$, has been previously discharged, and the primary current is only passing through the legs of $a+$. The magnetic moment of the entire ring-



FIGS. 5 AND 6.

magnet is therefore now only one-half of what it would be if both rods $h-$ and $a+$ were surrounded by the magnetizing current, for it is proved by well known experiments that in rings the magnetic moment is practically the same at every part of the circuit, no matter where the magnetizing coil may be situated.

While previously both bars $h-$ and $a+$ were magnetized (as are now those of $a-$ and $b+$), the magnetic movement was of course double what it is now, after $h-$ has been disconnected, and if now $a+$ is disconnected, the magnetism vanishes in $h-$ as well as in $a+$. Consequently the induction due to the remaining (one half) magnetism is now divided between the coils of $h-$ and $a+$, so that for this reason the tendency to produce sparks is reduced to one fourth. The other rod, $a-$, belonging to the same pair of brushes also, cannot now demagnetize fully, because its partner $b+$ is still being magnetized. The entire iron of this ring can consequently be demagnetized at most to one half, and only one half of the induction due to this reduction can act on the coils $b+$, tending there to strengthen the principal current. By this arrangement of connecting the coils belonging to the rods of two different ring-magnets, the tendency to produce sparks is greatly reduced.

To make the flow of the principal current still more smooth and constant, a large number of magnets of less dimensions may be used. Then the brushes would have to be disposed so that two brushes are constantly bearing on the segments G^{I} G^{II}, and more than four segments J, connected by rods n, would have to be placed side by side. The primary current would then flow in two series, which are connected two in parallel. The sparks would be still more reduced if more than two rods are connected to form one closed circle and these connected with the brushes in such a manner that each pair of the latter has connection with rods belonging to different magnetic circuits.

The Telegraph of 1622.

A correspondent of the French journal *Cosmos* states that in a curious old work printed at Paris in 1622 there occurs a remarkable passage, of which the following is a

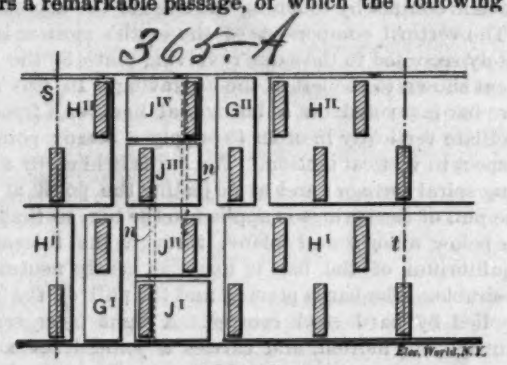


FIG. 7.

translation: "We may also tell you this great and wonderful secret, which a certain German has shown to King Henry, and who, by his industry and dexterity, is able to speak and to converse with those who are far away, and this by means of the magnet. He first rubs together two needle magnets, and then places them each separately upon two clock dials, around which are engraven the twenty-four letters of the alphabet. If, then, they wish to speak together, or to make each other understand what they would desire, they move one needle around until it has pointed to the letters which are necessary to make the words and sentences that they would say, and as they turn one needle so also the distant needle turns, making always the same movement. The King seeing this wonderful secret forbade him to divulge it, fearing that thus would be opened very dangerous communications between the armies of his enemies and their

ORIGINAL DEFECTIVE

besieged towns." The title page of the work in which the above passage is said to occur is as follows: "L'incredulité et mescreance du sortilege plainement convaincue Par P. de l'Ancre, conseillor du Roy en son conseil d'Estat à Paris. Chez Nicolas Bvon, ruë Sainct-Iacques, à l'enseigne Sainct-Claude, et de l'Homme Sauvage, MDCXXII." The notion that two magnetic needles by being rubbed together would afterwards move in sympathy, finds a place in more than one book of marvels of the 17th century, but the above date is, we believe, the earliest to which it has yet been traced.

Ewing's Seismographs.

The illustrations on this page, for which we are indebted to *Engineering*, represent the seismographs originally designed by Prof. J. A. Ewing for the Seismological Observatory of the University of Tokio. They have, however, been considerably improved in detail from experience gathered during six years' use. Fig. 1 shows a horizontal pendulum seismograph. This instrument records the two horizontal components of each successive displacement of the ground, together with the time, on a smoked glass plate. These two records are made by two horizontal pendulums pivoted on the same base by sharp steel points resting in cone and V-shaped steel caps and grooves; these pendulums form two steady points, the one with reference to north-south motion, and the other to east-west. From each pendulum there projects a pointer which multiplies the motion, and traces a magnified record of the earth's motion on a plate of smoked glass. The two records are made side by side.

The plate is driven at a uniform speed by the clock shown to the left of the figure, the motion being transmitted through a friction roller. The speed of the clock is controlled by a balanced centrifugal governor furnished with vanes which dip into a vessel containing castor oil. The clock is ordinarily at rest, and is started by the preliminary tremor which always precedes an earthquake. This tremor acts on a Palmieri seismoscope, shown at the back of the illustration, and causes it to complete an electric circuit, and thus release an electro-magnetic detent. This seismoscope is a short pendulum, ending in a platinum point which hangs just over a depression in a cup containing a small quantity of perfectly clean mercury, and ready, when the slightest disturbance occurs, to make electric contact by touching the edge of the depression.

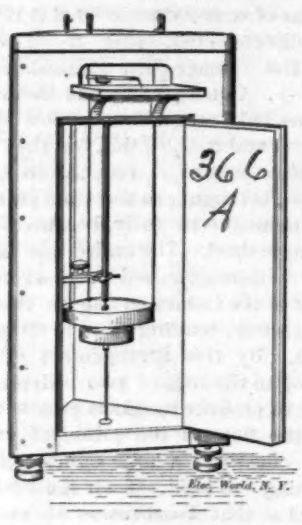


FIG. 2.—EWING'S SEISMOGRAPH.

The vertical component of the earth's motion is separately recorded in the same revolving plate by the instrument shown to the left of the engraving. In this a massive bar is pivoted on a horizontal line, with freedom to oscillate vertically in order to supply a steady point with respect to vertical motion. The bar is held up by a pair of long spiral springs; and by adjusting the point at which the pull of the springs is applied to the bar, so that it may lie below a horizontal plane, through the fulcrum, the equilibrium of the bar is made as nearly neutral as is desirable. The bar is pivoted and the pull of the springs applied by hard steel centres. A light lever serves to multiply the motion, and carries a jointed index which traces its record on a smoked plate.

Fig. 2 illustrates a duplex pendulum seismograph, designed to give a complete record of the whole horizontal motion of the ground on a fixed plate. It consists of a massive disc hung by three parallel wires from fixed supports, and geared by a ball-and-tube joint to an inverted pendulum pivoted in a hard steel cup in the base of the instrument. The two bobs are proportioned so that the combination swings in any azimuth in nearly neutral equilibrium. A recording lever is carried by a gimbal joint above the hanging bob; its short end gears into the bob by a ball-and-tube joint, while its long end carries a pointer which traces a multiplied record of the motion on a fixed plate. The records are fixed by varnishing the plate, and using it as a photographic negative.

Fig. 3 is an example of a small part of the record of an actual earthquake as given by a horizontal pendulum seismograph magnifying six times. The straight radial lines mark seconds of time. From a record of this kind the velocity of displacement and rate of acceleration of a point on the earth's surface may be determined, as well as the direction of each displacement. Fig. 4 is a complete record of another earthquake by the duplex pendulum seismograph.

A New Method of Maintaining the Vibration of a Pendulum.

A recent number of the *Comptes Rendus* contains a note by M. J. Carpentier describing a method of maintaining the vibrations of a pendulum by means of electricity, which differs from previous devices of the same character, in that the impulse given to the pendulum at each vibration is independent of the strength of the current employed, and that the pendulum itself is entirely free, save at the point of suspension. The vibrations are maintained not by direct impulsion but by a slight horizontal displacement of the point of suspension in alternate directions.

FIG. 4.—EWING'S SEISMOGRAPH RECORD.

This, as M. Carpentier observes, is the method naturally adopted in order to maintain the amplitude of swing of a heavy body suspended from a cord held in the hand. The required movement of the point of suspension is effected by means of a polarized relay through the coils of which the current is periodically reversed by the action of the pendulum, in a manner which will presently be explained. The armature of the relay oscillates between two stops whose distance apart is capable of fine adjustment.

It is clear, therefore, that the impulse is independent of the strength of the current in the relay, provided that the armature is brought up to the stop on either side. The reversal of the current is effected by means of a small magnet carried by the bob of the pendulum, and which as it passes underneath the point of suspension is brought close to a soft iron armature, which has the form of an arc of a circle described about the point of suspension. This armature is pivoted at its centre, and thus executes vibrations synchronously with those of the pendulum. These vibrations are adjusted to a very narrow range, but are sufficient to close the contacts of a commutator which reverses the current at each semi-vibration of the pendulum.

Chat About Edison.

The following newspaper talk about Edison comes from Philadelphia:

Thomas A. Edison is here buying electrical apparatus for his laboratory at Orange, N. J. He said to-day that he had spent over $2,000,000 in experiments. Then he sat down and told about his latest discovery, by which messages can be transmitted from ship to ship by means of steam whistles operated by keys very much like the telegraphic instrument. All his experiments so far have been confined to the waters of the Caloosahatchie, where he has succeeded in conveying intelligible messages a distance of one mile.

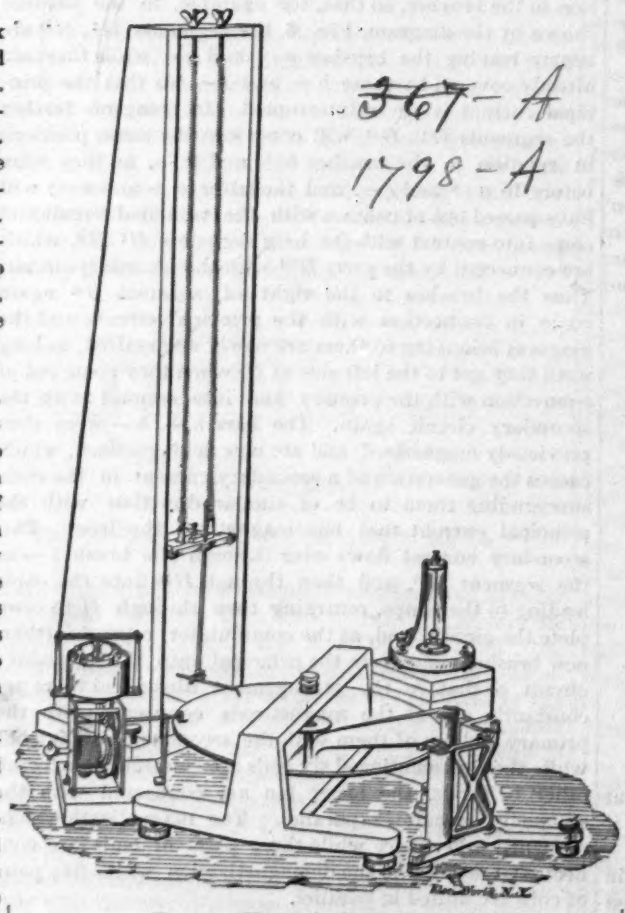


FIG. 1.—EWING'S SEISMOGRAPH.

The principle on which Edison will endeavor to perfect his experiment is the remarkable facility afforded by water for transmitting sound. Divers in the ocean have heard the swish of a steamer's wheels when fifteen miles away, and Mr. Edison thinks he can transmit his message from ship to ship a distance of at least seven miles. He purposes, after he has perfected his apparatus, to have the large ocean steamers equipped with the steam whistles and transmitters. Under the water line of each steamer will be a sounder connected with the captain's cabin by a thin transmitting wire running through a tube. When the captain of one vessel wants to signal another, he will sit down at his keyboard, turn the steam on his whistle, manipulate the keys, and send the message out into the waves that break against the sounder. This sound will pass unbroken from wave to wave until it runs up against the sounder of any vessel that may be within reach of the volume of sound.

As soon as the sound waves strike the sounder of the hull of the vessel within reach, the message will run over the electrical wire to the captain's cabin, where it will ring an electrical bell. An attendant will then take down the message as it comes from the water, by means of keys, as comfortably and correctly as though he were sitting in a telegraph office.

After the message has been received the captain can swing his vessel around and continue the message through seven miles more of water in the same direction until it strikes another vessel, when the operation may be again repeated until the breadth of the ocean has been crossed.

Mr. Edison seems to be confident that his experiments will succeed.

Death by Electricity.

A number of interesting experiments have just been made, says the London *Times*, with such electrical machines as are employed in industries, with the view of determining under what conditions they may become dangerous. These have been conducted by M. d'Arsonval, who has already established the fact that what is truly dangerous where these machines are used is the extra current that occurs the moment the current is broken.

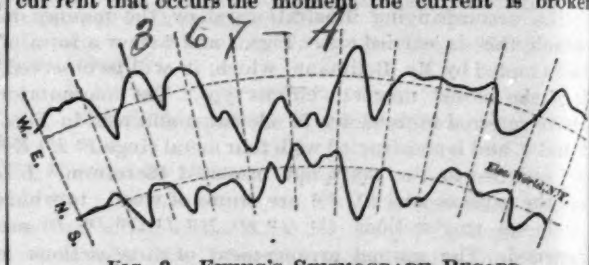


FIG. 3.—EWING'S SEISMOGRAPH RECORD.

and in order to annul this extra current he proposed to interpose a series of voltameters containing acidulated water along the conducting wire. The new arrangement now employed is at once more simple and efficient. It consists of a V-shaped tube made of an insulating substance, which after being filled with mercury, is interposed in the main circuit. In order to close the latter it is only necessary to turn a tap, which is arranged similarly to the tap on a gas-pipe. In this way, the machine is discharged without its being able to give an extra current spark. Another arrangement is also made use of, a glass tube being filled with mercury and dipped into a reservoir containing the same substance. This tube is provided with a ground stopper, this not only permitting the suppression of the extra current but also interposing any desirable resistance in the circuit. Although these details appear rather technical they relate to a most important matter. The use of electrical machines is increasing, and it is of practical use to know that currents are not dangerous until a power of 500 volts is reached. It is also of interest to know that the mechanism of death varies with the nature of the electricity used. Thus, with the extra current or with alternating currents, there is no anatomical lesion, and the patient can usually be brought back to life through the practice of artificial respiration as employed in cases of drowning. The discharge of static electricity from Leyden jars, on the contrary, causes a disorganization of the tissues that renders fruitless all attempts to restore life.

In a London Newspaper Office.—It is stated that the offices of the *Morning Post*, a well-known fashionable daily paper in London, will be lighted by electricity.

Jubilee Lighting in London.—The English papers to hand show that the use of the electric light for Jubilee celebration purposes was larger than the cable dispatches gave reason to believe. The Anglo-American Brush Corporation, the Gulcher Company, R. E. Crompton & Co., Messrs. Verity & Sons, Woodhouse & Rawson, Messrs. Faraday and Messrs. Laing, Wharton & Down, all were busy to their utmost capacity during the Jubilee week. Among the buildings illuminated for the occasion by electricity were the Stock Exchange, the Institution of Civil Engineers, the Junior Carlton Club, the Grand Hotel, Charing Cross, Draper's Hall, the Temperance Provident Insurance building, and the Royal Institution. A very large number of private houses were also made conspicuous by electric lights. The firms mentioned also had large contracts for lighting in the provinces and the Gulcher Company had a contract for illuminating Winchester Cathedral with a 10,000 candle-power Gulcher projector. The illumination of the Junior Carlton Club, by Verity & Sons, included no fewer than 28 2,000 c. p. arcs. Messrs. Verity also supplied 25 arcs for use on a triumphal arch at Kensington. There seems to have been a brisk demand for arcs of from 5,000 to 10,000 candle-power.

The Electric Lighting of Passenger Trains.*

BY G. W. BLODGETT, ELECTRICIAN BOSTON & ALBANY RAILROAD.

A better method of lighting passenger trains is demanded by considerations of economy, comfort and safety. Economy is a question which chiefly concerns the railroad management, but comfort and safety concern all their patrons. There are two ways in which we may seek these; either by improving the present system or by substituting a better one. It is doubtful whether oil lighting can be much improved and still be reasonable in cost, and whatever danger attends its use would probably still remain. I have made careful inquiry among my railroad friends without finding any instance within their personal knowledge, where the ruins of a railroad wreck were set on fire by the lamps in the train (indeed these are usually instantly extinguished), but such an instance was said by one of the survivors to have occurred in the late disaster at Hartford, Vt., and another was mentioned at a recent meeting of the New England Railroad Club, where the explosion of a lamp set a sleeping car on fire, and it burned with nearly all the occupants. It is, however, certain that a pile of splinters deluged with oil will burn more fiercely and be much more difficult to extinguish, than if in their normal condition.

It is therefore desirable to get rid of oil lamps for the harm they may do in *aiding* the progress of a fire, even if they do not cause one. The discomforts of oil lighting, in point of amount, distribution, unsteadiness and color of the light, corruption of the air, and the great heat given out by a large number of lamps in a car are other reasons why a change would be welcome to both the railroad management and the public, if a reliable substitute can be found. Some of the objections enumerated above apply with equal force to lighting by gas, the others are partially, but not wholly eliminated. *Electricity*, however, offers a means of lighting which comes nearer to meeting all the requirements of a perfect light for passenger cars than any other yet discovered.

There are several ways in which we may produce the electricity for car lighting. It is possible to light a car successfully by any one of them, but further experiment is necessary to determine which is the very best to adopt, and we have already found some much better adapted than others to our American trains. The different methods will be considered in order.

1. By primary batteries. I only know of one experiment successfully going on at present. A train has been running for nearly a year between Paris and Brussels, the cars of which are lighted by electricity from a bichromate battery. It lasts for five trips of seven hours each—that is, 35 hours of lighting—without renewal, which is said to take only five minutes. No accurate estimate of cost, or more detailed information is yet at hand. There are several other batteries in the market which appear well, and if the motion of the train does not have a deleterious effect, would seem possibly adapted to this work. My own experience is conversant with only one trial of this kind, which did not succeed. Forty cells of a battery which had worked well in several house installations were put in boxes suspended from the bottom of a car, and 16 (?) lamps of 16 c. p. each, put up in the car. The lamps burned well for one night, but the next night there was the appearance of a sudden and enormous increase of internal resistance in the battery, and it was removed for further experiment before trying to light cars. An attempt was made two or three months ago to light a N. Y. C. passenger car with batteries of some kind, which also failed, as I am told.

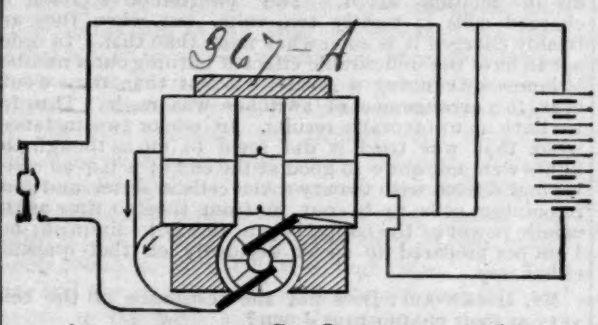
Most primary batteries furnish a continuous current for so short a time without renewal that their use is debarred on this account. Some others will not bear the shaking up produced by the motion of the train. I have myself experimented for a considerable time, but thus far without finding a battery which will run on a closed circuit longer than two or three weeks, and at the same time can be carried on a train. When such a one can be found, which at the same time gives a current strong enough to light a series of lamps, it will have a great field of usefulness.

2. By a dynamo machine. There are three ways in which this has been done. A small dynamo and engine have been mounted on the boiler or tender, and the latter run by steam from the locomotive boiler. The great objection to this method is that there is no light until the engine is attached to the train, nor if it be temporarily removed. To obviate this difficulty a separate boiler, engine and dynamo have sometimes been carried in the baggage car or on a platform car at the head of a train. It would seem that the danger from fire in this arrangement would be quite as great as by the stoves in the cars. A method tried with some success in a few instances in England and elsewhere abroad (but only once in this country to my knowledge), is to run the dynamo from one of the axles of the train, the proper speed being obtained by suitable countershafting and belts between the axle and the pulley of the dynamo. Since there would be no light when the train is at rest or when the dynamo was running at too low a speed, a battery of accumulators is added, sufficient to keep the lamps lighted for the longest time when the train is standing in the station, or elsewhere. When the train stops, or is at too low a speed for the dynamo to light all the lamps, they are automatically switched to the circuit of the accumulators, where they remain till sufficient speed is again attained when they are switched back on the dynamo circuit. During the day when the train is running, the dynamo charges the accumulators and keeps them full. They are sufficient to light the train several hours if need be. On one train in Germany, the dynamo and 23 accumulators weighed 1,350 pounds and cost about $625, operating 12 lamps; cost about two cents per hour, or one-sixth of a cent per lamp per hour. The London, Brighton & South Coast Railway Company fitted up four trains in this way. In one train of 11 cars there are thirty-two 16 c. p. lamps, absorbing 40 ampères of current. The accumulators are stated to hold 500 ampères (probable 500 ampère-hours is meant), and when fully charged are stated to be sufficient to maintain the lamps for eight hours. This train has been running since Dec. 19, 1883; during the first 11 months it made 2,352 trips, and ran 27,322 miles. No failures are reported. A train on the South Eastern Railway has even run a longer distance. The dynamos on these trains have an E. M. F. of 45 volts and give 56 ampères of current. Two pairs of brushes are mounted on a rocking frame, so contrived that when the train runs in one direction by means of a lever loosely connected with the dynamo-axle, and varied in position by attraction of the pole pieces of the field magnets, it tilts the frame in the direction to bring one pair of brushes in contact with the commutator. If the train runs in the opposite direction, the other pair of brushes are brought to bear on the commutator. A vessel containing mercury has revolving within it a coarse threaded screw driven by a belt from the dynamo-axle. At each end of the vessel is a vertical tube, at the upper end of which is an adjustable contact screw. When the dynamo and, consequently, the screw revolves in one direction the mercury rises in one tube. If the motion is reversed, it rises in the other tube, and when it makes contact with the screw, the shunt circuit of the dynamo is joined up, the field magnets are charged, the lever is drawn up and one pair of brushes brought to bear on the commutator, which completes the circuit for charging the accumulators. When the lamps are lighted and the train is in motion the dynamo feeds them, the accumulators merely acting as a regulator. If more current is being generated than the lamps require, it goes to the accumulators. If less, the balance is given out by them. When the speed of the train slackens the fall of mercury in one of the tubes breaks contact with the adjustable screw, the field magnet circuit is broken, and the brushes are removed from the commutator, the lamps continuing lighted by means of the current from the accumulators.

The apparatus can be used for several weeks with no attention beyond lubrication, and at the end of this period only a re adjustment of the commutator brushes is necessary, which puts the machine in condition for a like longer period. The weight of the apparatus is about two tons.

The connections between the cars are made by coupling two cables together. A slightly different arrangement of circuits has the field magnets of the dynamo wound with two wires in opposite directions, one of which is in shunt to the armature, as if the dynamo were an ordinary shunt machine. The other is wound as if the dynamo were a compound machine, and the accumulators are in series with this wire. The lamps are also in shunt with the armature. (See accompanying illustration.)

There is a cut-out to break the circuit of the armature when the dynamo runs below a certain speed; this prevents the cells discharging themselves through it and burning it out. If the dynamo does not furnish current enough for the lamps, the accumulators supply the balance, and in doing so, strengthen the field magnets and cause an increase of current in the dynamos. When this reaches a greater amount than that needed by the lamps, the surplus goes to the accumulators, and at the same time decreases the magnetism in the field-magnet so as to preserve the balance. At the maximum speed of the machine, the cells are receiving their maximum charge,



ARRANGEMENT FOR CAR LIGHTING FROM AXLE.

and the current to the lamps is of normal amount. Two sets of brushes are here necessary, as in the other case. Mr. Barrett, of Springfield, Mass., has fitted a train of three cars on the Connecticut River Railroad, with electric lights to be run from a dynamo in something the same way as these just described. The peculiar arrangement of the trucks under an American car renders it a matter of difficulty to obtain the proper speed of the dynamo, and I am told Mr. Barrett has had much trouble with the connections between the axle and countershaft. If these are not kept tight the cable slips. If too tight it breaks. An ingenious device like a friction clamp transmits the power from the countershaft axle to a pulley upon it. This is governed by centrifugal weights balanced by stiff springs. When the dynamo runs at its normal speed these just balance the friction of the clamp, and there is no slip. Any increase of speed then causes the friction to diminish, and the pulley slips upon the shaft, till equilibrium is restored. Twenty-four Julien accumulators are connected with the circuit as a regulator, and to keep the lamps lighted when the train stops. A centrifugal governor breaks the circuit of the accumulators when the speed slackens.

A third arrangement of electric car lighting is by accumulators on the train, to be charged by a dynamo at a central station or terminus of the road. In England a Pullman train has been running some years lighted by electricity, supplied by accumulators charged when the train is at rest by a dynamo driven by a gas engine. The Pennsylvania Railroad Company experimented more than two years ago with accumulators charged at one end of the line. When the train arrived at Jersey City the trays containing the cells were removed from the car to a charging room, their places being supplied by spare cells previously charged. The empty ones were charged to be replaced in the first car needing its batteries changed, and these in turn to serve other cars. The changing of the cells in a car took about ten minutes. These experiments were in the main satisfactory, but the weak point was the life of the cells, the plates of which after a time buckled and fell to pieces. These cells were furnished by the Brush Electric Company for these experiments, but they declined to send out any more to be used in the same way until the Pennsylvania Railroad experiments should be ended. The estimated cost of fitting a car with 10 lamps and batteries for 70 ampère hours was about $300 per car.

In the month of January of the present year, the Julien Electric Company placed 60 cells of their accumulators in boxes on car No. 90 of the Boston & Albany Railroad, and put ten 16 c. p. lights in the car. These proved to be insufficient and the number was afterwards increased to 24, of which 20 were on the car and four over the platform. This car was run some two months as an experiment, with such excellent results that in March and April the trains leaving Boston and New York at 4:30 P. M. every day were fitted up with the same system. (These trains are also heated with steam from the locomotive, and there are no fires or oil lamps in any of the cars.) Each coach and parlor car is fitted with twenty-two 16 c. p. incandescen lamps, of which two are over the platforms, 16 in the body of the car and the rest in the vestibules and toilet-rooms. The lamps in the car are arranged opposite each other in two rows in the top of the car, and are on two circuits entirely independent of each other, each of which has a switch of its own by which the lamps may be turned on or off. The platforms are so arranged as to be lighted from either end of the car. They may, if desired, be lighted only just before reaching a station and extinguished just after leaving it.

Sixty cells of Julien accumulators are arranged in boxes under the car, 30 cells on each side. The weight is about one ton. The boxes are neat and ornamental in appearance, and the 30 cells on each side of the cars are entirely independent of those on the other side, and are separately wired as far as the switch-board.

The cells have a capacity of 150 ampère hours and 60 volts on each side of the car. As 60-volt lamps are used, the accumulators on each side of the car will run all the lamps, but of course for only half the time the whole will do it. They are arranged in trays of six cells each, furnished with handles; they weigh 200 pounds and can be raised from the ground and put in the car by two men. The trays are fitted on the outside with stiff brass springs, which, when the trays are in place, bear against each other, and form the connection between each tray and the next. When the trays are in place in the boxes the connections are all made. There are, therefore, no wires to disjoin or connections to make, when it is desired to remove a tray for examination or otherwise. From the boxes on each side of the car, wires are carried underneath the car to a switch-board in one of the toilet rooms, which also receives the terminals of the lamp circuits. The switch-board is so arranged that the number of cells in use can be varied from 27 in series to 30 in series, the others being added from time to time, to keep up the candle-power of the lamps, as the E. M. F. of the cells falls. Experiments are now being made to do away with the necessity for this, and if it is found practicable, it will be discontinued.

Two terminals underneath the middle of the car on either side serve to connect by means of plugs a pair of cables connected with wires leading to a dynamo in a lighting station a little way off. These terminals are of different size, so that no mistake can be made in the connections. When the accumulators are charged the whole 60 cells are placed in series; when they are connected to the lamps there are 30 cells in two series coupled together. In order that there should be no confusion or errors in doing this, I designed a switch which should, by a single movement in one direction, of four levers coupled together, throw all the cells in series and connect them to the dynamo circuit. In this position they are entirely detached from the lamp circuits and no current can pass to the lamps. When this switch is thrown in the opposite direction, the cells are cut off from the dynamo, coupled in two series of 30 cells each, and connected to the lamp circuits, which, however, do not light until turned on by the special switches for that purpose. (Switch exhibited.)

It is quite unlikely that an accident to either of the lamp circuits or the batteries on one side of the car would disable the other. By turning out the lamps on one circuit, therefore, the others may usually be kept burning till the train arrives at its destination. In two instances this arrangement of circuits has proved very valuable.

All the cars, except one, are fitted with Weston incandescent lamps said to take 1.1 ampères. The remaining car has Edison lamps, which are proving so satisfactory that it is quite probable all new work will be equipped with the Edison apparatus.

When the train arrives at Boston it is put on a side track near which a line of poles has been set and the dynamo wires strung upon them. Opposite each car a pair of terminals serve to make connection with the car and the charging begins. A current of 18 ampères is run in for several hours, dropping to 12 and sometimes 10 ampères toward the end of the charge, which is now 180 ampère hours to the 60 cells in series. If there were no loss we could draw out 360 ampère hours in the lamps. Assuming that the lamps use 1.1 ampères each, we actually use about 22 × 1.1 ampère × 9 hours = about 216 ampère hours, or 60 per cent. of what is put in. If the lamps are required an extra hour or two there is plenty of reserve for them. The attempt was made to reduce the charge to 140 or 130 ampère hours, but as some of the batteries were not in first-class condition the results were not so good.

Mr. A. Reckenzaun, in a recent article on storage batteries, gives the average efficiency as not less than 70 per cent. The Julien company claim, I understand, 80 to 85 per cent. for theirs. Doubtless this can be realized under special conditions, but my own experience would not warrant me in assuming so much in car lighting—at least until the most favorable conditions of use are better understood.

The intention is to always have a surplus of current in the battery. For the present, the trains run a round trip to New York and return with once charging, but it is not yet quite certain that it can be done in the long nights of winter.

The cost of fitting these cars with accumulators and lamps was, when complete, about $900 per car. Others fitted in the same way would cost less, as on this work the men were all inexperienced and there were no plans or precedents. The cost of operating the lights is not far from $2 per car per day, or about one cent per hour per lamp. When the lights are needed a longer time, as in the dark days of winter, the cost per lamp hour would diminish. This is about ten times that of oil, and very nearly the same as for gas, but taking into consideration the amount of light obtained, electricity is the cheapest of the three, and immeasurably the most convenient. The light is very brilliant, well diffused, steady, and satisfactory beyond all expectations. A very noticeable feature of these cars is the great absence of heat, and the purity of the air, which is as fresh and sweet in the car at the end of its trip as before it leaves the first station; this together with the absence of danger from fire, especially commends it for sleeping cars. Several trains are now also being lighted with accumulators by the Electrical Accumulator Company with satisfactory results.

The electric light has come to stay. It is the only one which anywhere near fills the conditions of a satisfactory light for railway trains. It can be readily adapted to almost any conditions to be met with in practice.

Oil lamps and stoves in cars, must follow where the old couplers and hand brakes for passenger trains have gone

* Read before the American Institute of Electrical Engineers, June 28, 1887.

in this country, until electricity and steam heat have made the roasting alive of scores of people pinned fast in a railroad wreck as impossible as the air brake and Miller platform have made the telescoping of a train into a shapeless mass of ruins, as was formerly the case. Not many years hence, we may well hope, one will be as uncommon as the other.

DISCUSSION.

Mr. R. W. POPE: I had the pleasure of coming from Boston a week ago to-night in a train equipped with the lights which Mr. Blodgett has described so successfully, and having in view the fact that this paper was to come before the meeting, I perhaps gave the light more attention than I otherwise would. The first and most notable feature of the installation to my mind was the fact that it appeared to be permanent. It was not experimental in the sense that so much electric lighting that we have seen has been. Wires may have been there, but they were not to be seen. The lighting of the cars was certainly the best lighting that I have seen, with the exception, perhaps, of that of the Electrical Exposition at Philadelphia. The cars were lighted up in the station before leaving Boston at 4:30 in the afternoon, as it was dark in the station. That was the first advantage I saw. And, although early in a summer afternoon, there was no difficulty whatever in turning the lights on to give a good illumination while the cars were in the station. After leaving the station, of course, they were not required until dark. I think we reached darkness at about Hartford, and not having the scenery to gaze on I turned to a book I had with me, and was very much pleased to find I could pass the time in reading without any strain on my eyes, and one curious feature of it was that, being absorbed in my book and having been looking out of the windows for two or three hours, I turned once or twice to look out again, and was surprised to find it was dark outside: there was nothing to look at. I had almost lost sight of the fact that it was artificial illumination, and this was certainly a very pleasant feature to think that I could read by a light as perfect as day light and slightly more perfect than some day light that they have on the other side of the water. The lights are turned on in going through tunnels or when you come to dark stations, and I think that is a very desirable feature. The element of safety is one that is particularly noticeable, because we have heard so much of the dangers of a fire from electric lighting. But now, when it comes to requiring safety on railway trains from fire they turn to electric lighting as the only resource, and there is no doubt but that danger from fire is entirely eliminated by the use of incandescent lights from storage batteries as they appear on that line. I am contrasting this wiring and installation very favorably with another installation of car lighting that I saw on the same trip, where the wiring in a baggage car and passenger car bore evidence of having been done by some Western Union lineman who had not been in the business very long. I was not very well pleased with that as far as the wiring was done. The expense the Boston & Albany Railroad Company has been to in making this installation reflects a great deal of credit on the progressive management of that road. (Applause.)

The PRESIDENT: I would like to ask Mr. Blodgett a question. You state that the cost of electric lighting was ten times the amount for oil. I would like to have it specifically stated, if you can do so, whether that applies to the whole of the apparatus or simply to the service?

Mr. BLODGETT: My figures in relation to the cost of oil lighting were taken from a report by the Master Car-Builders' Association, I think about ten years since. My impression is that in that report they only took into account the actual consumption of oil for lighting. It is my impression that no account was made of the cost of the care of the lamps or their renewal, when it should be necessary, or anything of that kind. Their figures show that oil lighting costs about one-tenth of a cent per hour. As near as I can estimate from our own experience with electric lighting it is not far from one cent per hour, which would be, roughly, ten times the cost of oil lighting, not counting the cost of the renewal of the plant, or, as my impression is, the cost of repairs to oil lamps. However, I am not certain about that.

The PRESIDENT: As I understand it, the cost of electric lights in a car is materially less. I am speaking of the lights themselves. Is not that the case?

Mr. BLODGETT: The fitting of the car with oil lamps will cost anywhere from $12 to $50 for each lamp, and if, as is usual, from twelve to fifteen lamps are put into a car, it would cost not less than $150. The cost for an equal number of electric lights would not be over $24.

Mr. G. M. PHELPS, JR: May I ask Mr. Blodgett whether in making up the figures of cost of electric lighting he first entered the item of depreciation of the storage battery plant, its consumption?

Mr. BLODGETT: It is difficult for me to estimate just what they would be. The assumption was made that the batteries would last two years.

Mr. PHELPS: Then your figures proceed on the basis of the renewing of the batteries in two years.

Mr. BLODGETT: I think that was the estimate. I ought perhaps to say about these figures that the time during which the apparatus has been operated is so short that the figures are only roughly approximate. It may prove to be very much less than this, and possibly, but not probably, it seems to me, somewhat greater.

Mr. E. E. RIES: What proportion of the cost for lighting is due to the cost of handling the batteries, and what proportion is due to the interest on the installation?

Mr. BLODGETT: There is no expense of handling the battery. The charging of it has been done thus far at the rate of seventy-five cents per car per day. I think it will cost somewhat more in the future, as the electric lighting companies who are doing it complain that that does not pay the cost. Possibly it may cost $1.50 a day per car for the charge.

Mr. RIES: According to that the cost per lamp, simply for the charging, would be about five cents?

Mr. BLODGETT: Roughly that.

Mr. WM. BRACKEN: I can state that the cost of charging Julien cells per car is about thirty-three cents. The Weston Company in Boston charges $1.50 per car. I may say here that about six or seven days ago I met Mr. Pullman, and I remarked, among other things, that the chief objection to lighting railroad trains by electricity seemed to be the expense, and he said—of course it was his own opinion, but it has considerable weight, coming from a man of his experience,—that the mere matter of expense would not stand in the way of lighting by storage batteries if it were proved to be practicable. Then we have the opinion of another gentleman who has a great deal of experience, Dr. Dudley, of the Pennsylvania Railroad. Two years ago, you know, that road experimented with storage batteries. Dr. Dudley has come to the conclusion, as a result of his experience, that the only thing now wanting to induce the Pennsylvania Road to adopt the storage batteries is a simple connector for cells whereby a plate could be removed which showed any disposition to deteriorate. So far, we have been unable to get a connector that we could remove and adjust without considerable trouble, in order to remove a defective plate. The chief objection made by parties in relation to lighting by storage batteries is the fact of cost—the first and the only objection—but experienced railroad men, as I have told you, do not seem to regard that as a serious objection any more than is the cost of a parlor car in comparison with an ordinary passenger car.

Mr. POPE: I would like to inquire whether the objection to cost is on account of the original cost of the plant or the cost of the running of it after it is installed?

Mr. BLODGETT: I think that both those arguments have been used as an objection to the introduction of electric lighting; but if account is taken of the amount of light furnished by the electric light in comparison with gas or oil, that item of expense will disappear. If people would be content to have as little electric light as they get with oil or gas, the expense, it seems to me, would be no greater; but the change in lighting is the excuse for getting three or four times as much light as is furnished by the old system. In that respect the cost of electric lighting is made to assume a very undue proportion in relation to the cost of other methods of illumination, and there, it seems to me, is a very prominent reason why the electric light fails to make greater progress; viz., that with the change is demanded an enormous increase of light.

Mr. T. D. LOCKWOOD: Mr. Blodgett among other statements in his paper remarked upon a method of introducing first only a comparatively small number of cells and, as exhaustion supervenes in those cells, a few more are introduced and then a few more. I would like to ask him whether experience has demonstrated that to be a better method than introducing the full number of cells at first, and with them a certain artificial resistance, and then switching out the resistance as occasion would demand?

Mr. BLODGETT: I would say, in answer to the question, that the number of cells was never varied more than four on each side. We started with 27 cells in series and ended with 30 in series. We have run trains on trips with the whole 30 cells in series, and, I might say, with substantially the same results. There was no opportunity for me to determine by experiment, previous to running these trains, any of the questions which have come up in relation to it. The electromotive force of charged cells is rightly two volts, but when they are freshly charged it is somewhat more than that. In order not to have the undesirable effect of burning out a number of lamps by running a greater current than they would bear, this arrangement of switches was made. Thus far we have no unfavorable results. In one or two instances when that was tried it did seem to me as though the lights were not quite so good at the end of a trip as when we had started with twenty-seven cells in series and four remaining cells to be put in from time to time as the candle power of the lamps began slowly to diminish; but I am not prepared to speak decidedly on that question either way.

Mr. LOCKWOOD: Does not the resistance of the cells vary as their charge runs down?

Mr. C. O. MAILLOUX: I think I can give some information on that subject to Mr. Lockwood. I hardly think the question needs to be answered, because probably every one who has experimented with primary batteries knows that you can take freshly charged bi-chromate cells, say Fuller cells, and if you wish to make a constant difference of potential across a certain part of the circuit, you can use a part of them at first, and, as they weaken, add more to the circuit. The only difference that it makes, as far as I know, is that you are adding cells which have not been worked so much, and they would not give out so quickly as the others. In other words, the number of ampère-hours that would be obtained from these freshly added cells would not be so great, and in practice, using them, as Mr. Blodget states, those cells that are added last are never discharged to such an extent as the others; consequently there is some energy left in them at the end of the trip. It would doubtless be practicable to use resistance as Mr. Lockwood suggests and to discharge the cells, but there would be nothing gained by it except perhaps the inconvenience of handling the resistance. It is much simpler to use only those cells which are necessary to get the proper electromotive force and to add cells as the electromotive force falls, and those cells which are put in last, if they are not fully discharged, are in much better condition, because we find in working storage batteries that it is not well to charge a storage battery too much. Indeed, I may say that the greatest grievance we have against storage batteries is that the public will insist on trying to give to the storage battery a greater capacity than the maker himself would like to have it go out for.

The fact of the matter is that there is an intimate connection between the life of a cell and the way in which it is handled by the person who buys it, and as I just said, the trouble comes mainly from the fact that the cells are over worked. As long as a cell is not fully discharged, the peroxide on the positive plate is to a certain extent infiltrated with sulphate that has been produced by the chemical reaction during discharge. But if we proceed so far that a large quantity of sulphate becomes formed at the expense of the peroxide, then we shall find, when the process of discharging is again resumed, that we can no longer reconvert that mass of sulphate into peroxide; and wherever the process of charging is stopped there will be a process going on by which that sulphate will undergo a fresh reaction and become hardened. The consequence will be that a line of demarkation is produced and a scale results. That scale is the beginning of trouble, and a great many times the beginning of the end with a great many storage batteries. Now, if we do not discharge the battery too much we leave a sufficient mass of peroxide to add conductivity to the mass of sulphate so that the process of discharging can proceed without difficulty. That is why it is better to use the three or four cells which are added and which are necessary to rejuvenate the force of the rest than to discharge them all equally. Those three cells are not discharged so much as the others. Consequently they are not so much used; and by the process of changing the trays once in a while, so that they all have this little holiday at the end of the trip, the amount of life thus given to the battery could be averaged through the whole number of them. (Applause.)

Mr. JOS. WETZLER: Mr. Blodgett in his paper enumerates the different methods by which trains may be lighted, and in all of them, except the one in connection with which he mentions the primary battery, we find that where we want a steady light the storage battery must be added to the equipment. Although he says he has had experience with only one of this kind, I would like to ask if he has formed any opinion upon the ultimate shape which the application of the storage battery will assume—whether it will be charged on the train, or whether it will be charged at the terminus only.

Mr. BLODGATT: That is rather a hard question to answer, since it must be on my part merely a matter of opinion. It does seem to me, however, that some one will find a way by which the battery can be charged on the train with regularity and with good results. If that can be done it will much simplify the use of the storage battery, since the charging will then take no extra time, and would, it seems to me, give better results than being obliged to charge the batteries every day or every other day. I know no practical device at present to accomplish that result. The reason why it is successful in England is because of the different arrangement of the cars. Most of the English cars on which it has been tried have, in place of our trucks at either end of the car, only a single axle and a pair of wheels which are fixed with sufficient rigidity so that they can run a dynamo shaft. But American cars have a flexible, movable truck at each end from which it is difficult to convey power to any other piece of machinery when going along the curves.

Mr. RIES: The feature that Mr. Blodgett just mentioned, viz., the difficulty of making connection between the axle and other mechanism, is, of course, one of those difficulties which only time can overcome. But it seems to me that, instead of equipping in such a way that the battery must either be removed from the car or that the car must be side-tracked and remain idle for eight hours, more or less, a system can be devised in which the battery carried by the car is a permanent fixture and receives its charge during the time that the train is running on down grade by a dynamo, absorbing the surplus energy or momentum of the train itself, whereby the direct application of steam co-operating with the dynamo can be obviated. One of the great objections to these various steam-heating systems, is that in order to maintain a separate system of heating, the locomotive would have to be drawn on very considerably, and that is found somewhat impracticable. The very same objection would obtain in the use of a battery, but on large trunk lines there are numerous trains on which it would seem that the momentum which is in excess of the speed at which it is desired to run could be readily converted into chemical energy, which could be stored in a battery until required. It might be so arranged as to receive all the current that is generated at regular intervals, and in a simple way this could be made to furnish the current for lighting. Several of the members here would be pleased to know whether Mr. Blodgett has had in his experience any such system, or whether he knows of any such system being proposed for utilizing the electric current for lighting railway trains.

Mr. BLODGETT: I do not know of any such system. It seems to me that the amount of power required to light a train electrically is so very small that it would not be a serious question if the locomotive is so nearly worked up to its full capacity that it could not spare two or three horse power more when running between six hundred and seven hundred perhaps, or possibly eight hundred or nine hundred horse power; if it could not spare two or three more for lighting the train then it would be necessary to attach a second locomotive to keep up the speed of the train around the curves. The objection that the heating of the train would make a draft on the locomotive has also been brought up lately, but practical experiments have failed to show that steam heating does have such an effect. The amount of steam required for heating a train is very small, and a pressure of two to five pounds, even in very cold weather, with proper piping of the cars and proper connections, will sufficiently heat the train, and when the locomotive carries 160 pounds steam, as the best kind of locomotives do, a pound or two more is not a serious percentage of loss.

Mr. T. D. LOCKWOOD: There may perhaps be a word or two which might pertinently be said in regard to the English installation on which Mr. Blodgett has said something. The system which obtains on the London & South Coast Railway is, as we have heard, operated by the shaft of their cars, and, as Mr. Blodgett has said, they do not use trucks at all, but simply a pair of wheels. The method of getting the power to the dynamo is by using an extra counter shaft and running two belts. That is a point worthy of notice, a pulley on each side of the train, running two belts to the counter shaft. Although it was not done so at first they have recently adopted two more belts from the counter shaft, putting the pulley on both ends so as to insure running at all times. They also have a very ingenious method of keeping the belt stretched by screws at both ends, both operated by one handle by means of a worm gear which pushes the counter shaft into a position diagonally to or triangularly from the dynamo axle and from the first main axle of the car, so that it tightens up both series of belts. At the same time it seems to me, there is something which is more theoretically perfect in such a system, complete in itself, which has to carry the original power with it, to carry batteries and to maintain the light at all times, than there is in any other system. Of course the objection that is stated against that in this country is very weighty, but I think the time will come when our cars as well as our houses, our stores, and our business blocks, will be properly fitted for the use of every electrical appliance. One gentleman spoke, questioning in some degree, whether using the power of the locomotive to operate the shafts of the dynamo, it would not be detracting somewhat from the tractive power of the locomotive. Mr. Blodgett answered it very well, as I thought, but I think that question has already settled itself when we consider the English method of getting light on a train. I read very carefully the paper written by one of the inventors of that system before the Insti-

tute of Civil Engineers in London on that point. Mr. Blodgett remarked, when discussing the difference of cost, which seemed to be considerably in favor of oil over electricity, that the amount of light which we used to have under the old oil administration was not half as much as we get now. Well, we all know that is true. We did not get one-half or one-tenth as much light as we get now. It was worth one good pair of eyes to try to read for ten miles. But in view of the fact that when we get a certain amount of light from a certain amount of electrical power, it takes very little more electrical power to bring the light up to a much higher degree of brilliancy, it is a question with me whether, if we brought the light down to the old standard, the cost would be very much diminished. I rather doubt it.

MR. BLODGETT: It may be, Mr. President, that I did not make that part of my statement sufficiently clear. I meant to be understood as saying that if we put in lamps enough in a car only to light the car to the same degree of brilliancy that was obtained by oil, then the cost would be no more than that of oil; not by using the same number of lamps we are at present using, but by putting in a less number. We ought to consider that in a lamp of say sixteen-candle power, perhaps one half of the light and more is used by, or is cut off from available use, by the fixture of the lamp itself. In the electric light there is no fixture to cast a shadow or absorb the light, and withdraw it from a useful purpose.

MR. WETZLER: Mr. Ries has led the discussion in the direction which I think would still bear carrying out a little farther. He refers to the fact that where storage batteries are used on trains some account should be taken of a method by which trains running down grade shall be enabled to charge batteries; that these means must to a certain extent be automatic seems self-evident, and I believe Mr. Ries' modesty is such that he has withheld something from us that would shed some light upon the subject. I would therefore like to hear him speak on the subject.

MR. RIES: In respect to Mr. Wetzler's suggestion, I would state that while not fully at liberty to mention what he undoubtedly refers to, I might say that I have given some attention to this matter of accumulating the surplus energy of a train and storing it in the form of electrical energy, and among the problems was the one that Mr. Blodgett suggested in reference to the axle of the car, which we believe we have solved. In order to accomplish this I have devised a form of pendulum switch, or any other form of gravity switch will answer, whereby the amount of current produced by a generator for charging the battery is directly proportional to the inclination of the grade; so that as long as the train is running on a level, the field magnet coils of the generator are open, and the magnetic strength can be increased or diminished at will. The number of coils thrown in the circuit is automatically adjusted by means of this switch, before mentioned, whereby, when the train is running down on a steeper incline than before, it makes a stronger magnetic field, absorbs a greater proportion of the energy of the train, and generates a correspondingly increased volume of current which is stored in a battery for use as required. Now, the greatest expense in the present method of lighting railroad trains by batteries seems to be in the cost of charging. A further expense in some systems arises from the fact of using a double set of batteries, one of which is being charged while the other is being worked, both of which can be dispensed with, as well as the cost of handling. By means of a system of this kind the battery, when once in position, is self charging, so to speak. A sufficient number of cells are used to give the requisite number of ampère hours and the number of cells that we do use of course will be determined by the number of lamps that the train is running. The generator is so arranged that, as before stated, in running on a small incline the field magnet strength is slightly decreased, but as the speed of the train slackens, in case of waiting to come to a stop, the field magnet strength is automatically increased. We have both a gravity switch and a governor in this arrangement, so that the requisite electromotive force is produced until the speed of the train has very nearly ceased. In that way the battery will always have a sufficient supply of current in reserve, whether it be used for lighting or braking or whatever other applications you may wish to employ. (Applause.)

MR. MAILLOUX: I must say that I do not quite agree with Mr. Ries in his views on the subject of utilizing only wasted energy. This idea of using waste energy is very good in theory, but it does not always work in practice. A car starts from here to go to St. Louis or some distant point and it is going to be away a certain length of time. Now, what a practical lighting man, like Mr. Blodgett, wants to know, is how many lighting hours he is going to have and how many lighting hours the electric light has got. It is of far more importance to be able to get at so many ampère hours per mile than it is to take the chances of getting it at the next grade, or giving the engine a spurt so as to get it on going down a grade. Therefore, I believe that as the amount of energy which is constantly being drawn upon in a car making a long trip is so small, it will be better in practice to content ourselves to draw it directly without paying attention to what is being saved or to what might be saved. In a car traveling all day it is safe to say that, excluding the time of stoppage, we have something like twenty or twenty-two hours of travel. Now, if we so arrange the apparatus that we can draw a small current for those twenty-two hours, it is quite evident that the draft might be large, and doubtless the draft on the locomotive might be very appreciable. On the other hand, the hours of lighting will never be so long, because in sleeping cars after certain hours there are very few lights in use.

The system at which it seems to me we should aim is a system in which there is little or no complication. As you all know, the fact must be borne in mind that a train will run anywhere from ten to fifty miles an hour. Now, in order to compass the great variations consequent on such a change of speed, the minds of electricians have been filled with numerous devices of resistance regulators, etc. Now, I do not see that any system involving the application of complicated regulating devices of that kind can hope to be successful. We must have a system in which the mechanism is so simple that there are scarcely any details to it. Undoubtedly the day of lighting cars with an axle-driven dynamo is coming, and when it has come we shall find that the proper system is that in which the dynamo is taking care of itself without having to call upon a thousand and one details of machinery and clockwork to assist it in taking care of its work. (Applause.)

MR. RIES: Mr. Mailloux made a very forcible argument in support of the direct dynamo connection for generating purposes. I fully agree with him that that would be the simplest, as well as the best, system to adopt in practice on such roads, where for certain reasons the momentum system, suggested before, would not be applicable. But it is a well known fact that a great deal of power is lost every day on our trunk line roads from the very cause mentioned, and the secondary battery presents to us a useful and simple means of converting at least a portion of that energy into use. Now, I do not advocate this system on level or substantially level roads. It is only in cases where the advantages would justify its adoption that I would recommend it. For ordinary roads, however, the direct dynamo and battery connection, as recommended by Mr. Mailloux, is perfectly proper and probably the best plan to adopt.

Electro-Deposition of Iron.

In a paper read by Prof. W. Chandler Roberts-Austen, F. R. S., before the Iron and Steel Institute, the author described the methods he adopted to form a deposit of iron by means of an electric current, and gave some interesting data regarding the quality of the iron so obtained. The electro-deposition of iron is not a new art, and it has, in fact, already been practiced in Russia for the manufacture of iron types, from which the Russian banknotes are printed. One of these plates was shown to the meeting. But as regards England, Professor Austen is probably the first who has succeeded in an operation which presents some unusual difficulties. The secret of his success seems to be the very feeble current which he employs. He uses a wrought-iron anode placed opposite a cathode at a distance of about 1½ inches, and for a surface of about 90 square inches the current employed is only .089 of an ampère, given by two Smee cells coupled in series. The solution is a mixture of ferrous sulphate and magnesia sulphate. With so feeble a current the deposition naturally proceeds at a very slow rate. The matrix for the Jubilee medallion, which was shown, took three weeks to produce. The procedure is as follows: The cathode is of copper on which a thin coating of nickel has been electrolytically deposited. This is left in the air to slightly oxidize; then it receives a second deposit of nickel, and upon that the iron is thrown down. The chemical and magnetic properties of the iron so deposited are very remarkable; it is almost chemically pure, containing only a very slight trace of magnesium and .005 per cent. of sulphur. Its density when taken out of the bath is 7.675, but after annealing the density rises to 7.811, whilst at the same time a contraction in length of about 1 per cent. takes place. The magnetic susceptibility of the unannealed iron is surprisingly low, and that of the annealed sample is only about two-thirds of the value generally found for Russian soft wrought iron. The low density and low magnetic susceptibility are probably attributable to the large amount of occluded hydrogen which during the process of annealing is driven off, with a corrresponding improvement in the quality of the metal. Professor Austen also showed a plate of iron on which copper had been deposited. To the back of the iron plate was then glued a piece of wood and the deposit of copper was stripped off, but the split occurred not between the junction of the iron and copper, as might be expected, but within the copper itself, leaving a portion of that metal firmly adhering to the iron plate. This shows that the cohesion between molecules of iron and copper, when the latter has been deposited electrolytically on the former, is greater than that between the copper molecules among themselves.

The English Navy.—The British Admiralty has invited tenders for the supply of 34 sets of dynamos and engines. Five of the dynamos are to be of 400 ampère capacity, seven of 300 ampères and the remaining 22 of 200 ampères. All the machines are to have an E. M. F. of 80 volts.

Mine Lighting.—Professor S. P. Thompson has taken advantage of the opportunity offered by recent colliery accidents in England to call public attention to the safety afforded by the use of electric lights. He holds—and points to the facts confirming his views—that the employment of electric safety lamps furnishes the only real satisfactory guarantee against mine explosions.

An Electric Trumpet.—An electric trumpet has been recently devised by M. Zigang. It consists, says the London *Electrical Review*, of a short brass tube mounted on wood and containing an electro-magnet whose ends face a vibrating plate, on which is fixed a small piece of soft iron. Against the plate armature rests a regulating screw with platinum point, which serves for automatic interruption, by vibration of the armature. With two Leclanché elements a musical sound is obtained, which may be varied in pitch, intensity, and timbre by means of the screw. This instrument may be usefully employed in signaling on ships, railways, tramways, etc.; it may also serve as a receiver for signals of the Morse type.

A Racing Story.—The solemn service was progressing in Winchester Cathedral, England, and the Dean sat enthroned, when a telegram was handed to him. He opened it, and cast his eyes up to heaven in dire perplexity. It ran thus: "Ormonde has won." Who was Ormonde? and what had he won? Vainly canons and such-like minor lights were consulted. If they knew they pretended not to. It was subsequently discovered that the telegram had been sent to Mr. Dean, a trainer at Winchester, but as it was addressed "Dean, Winchester," it was handed to the Dean. The telegraph clerks were probably under the impression that this dignitary had put a trifle on the race, and had desired that the result should be at once forwarded to him.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, July 5, 1887.

The Ansonia Brass and Copper Company have a wide reputation for their insulated wire, including the finer sizes for magnets, to be used in telegraph instruments, telephones, electric lights, etc. The bare wire before covering is saturated with Splitdorf's patented liquid insulation, which is dried and finished on the wire. After this, the wire is covered with cotton or silk or a double winding of cotton throughout in opposite directions; or it is covered with braided cotton for office wire in any size or variety. The company use the latest machinery, and produce wire of the greatest uniformity possible, guaranteeing perfect insulation, freedom from oxidation, preservation of conductivity, and immunity from dampness. The liquid used prevents the covering from unwinding or slipping from the ends. The company insulate all kinds of wire to order, and are the sole manufacturers of the A. A. Cowles patented wires, full details of which may be found set forth in their price lists and catalogues.

The Isolated Electrical Accumulator Company is finding a large use for its cells in New York City. Thus there are already 100 storage cells in the Mills Building, 150 in the Gallatin Bank, 178 in the London and Liverpool Insurance Building, 66 in the American Bank-Note Company's Building, and 600 in the Metropolitan Telephone Building. This, I believe, is the largest plant in the world, and is fitly placed in the building where so many electrical interests are concentrated. The batteries are charged by an Edison dynamo, run by a New York Safety Steam Power Company's engine. In Philadelphia work of the same kind is going on. The Pennsylvania Railroad offices will have a plant second only in size to that mentioned above, and the American Insurance Company's Building has 180 cells.

Mr. P. A. Dowd, manager of the New York City agency of the Sprague Company, is working up quite a large business in motors, finding some new use for them every day.

The Board of Electrical Control, heretofore known as the Subway Commission, met in the Mayor's office on July 5 and organized. President Beekman acted in the Mayor's absence. On motion of Commissioner Daniel Gibbons, Commissioner Jacob Hess was unanimously elected president of the board and Theodore Moss secretary. The maps and other documents of the old Subway Commission were then formally turned over to the new board. Henry S. Kearney was continued as engineer to the board at a salary of $400 a month, and John W. Totten, messenger, at a salary of $75 a month. Commissioner Hess, after being elected president, made a brief speech of thanks, and stated that he would endeavor to do his duty to the best of his ability.

Work has been carried on very actively this week on the new electric railway for Fulton street, to use the Bentley-Knight conduit system, which you have already described and illustrated. The force has been busy night and day.

The New York Electric Brush & Ozone Company, 102 Fulton street, are improving their specialties in ozonized hair brushes, etc., and Prof. J. D. Culp, whose patents they manufacture under, is now in the city perfecting an "ozonizer" for applying electricity direct to sore or diphtheritic throats, and for lung cure. The instrument is not unlike the gas lighter, as it consists chiefly of the two rubbing discs. I need not dwell on the good qualities of ozone. The smell of it while the apparatus is in use is easily perceived by means of the simple mouthpiece to which the insulated conductors from the discs are led. It will be remembered that the company's hair brush is also made with rubbing discs, and I saw it applied the other day to a Geissler tube, when the current generated was very perceptible. The company continue to do well with their electric gas lighters, and though there has been some talk about the trouble of getting them to work in summer, sometimes, I have never yet seen the failure of any when properly kept and handled.

The United States Electric Lighting Company report business as remarkably good, the demand for plants keeping up as though there were no summer season. The Company have recently been installing 730 incandescents, with two dynamos, for the Goodyear Rubber Glove Manufacturing company, Naugatuck, Conn. Other recent work includes 600 lamps and one dynamo at the Patterson Mills, Chester, Pa.; 400 lamps and two dynamos at D. Trainer & Sons, Trainer, Pa. There has been an increase of 1,800 lights in the Philadelphia Post Office and of 250 in the Excelsior Needle Factory, at Torrington, Conn. Besides all the Eastern work, the Chicago office has obtained new orders for plants to the extent of over 8,000 incandescent lights, besides a large number of arcs. Altogether between 40 and 50 new installations are represented in the orders received by the New York and Chicago offices. It is worthy of note also that Weston dynamos have lately been found very serviceable in charging storage battery plants. The company's new factory will, it is said, give them three times the room they had before the late unfortunate fire.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, July 5, 1887.

The Edison Illuminating Company, New Bedford, Mass., is reported as having one of the most economical electric light stations in New England. Its three boilers are set with the Jarvis setting.

E. Frank Woodbury, mechanical and engineering expert, of Boston, recently completed the installation of a 300-light incandescent plant for the Bradley Fertilizer Company, at North Weymouth, Mass.

The Sawyer-Man Electric Company, through its New England agent, P. H. Alexander, has completed the large isolated incandescent plant at the Kearsarge House, North Conway, N. H. On the evening of June 30 the lights were turned on, and every lamp burned clear and bright, the hotel and its grounds being brilliantly illuminated.

Recently the Northampton (Mass.) Electric Light Company made some important changes and additions to the equipment of its station. This successful electric light enterprise has at present in use 115 arc-lights and 200 incandescent, both systems being from the Thomson-Houston Company.

The Newton Electric Light and Power Company has arranged to

light the stations of the Boston & Albany Railroad from Newton to Auburndale. The arc lights will be used outside and inside at first, the company having a method of subduing the light for interior illumination. An additional plant for incandescent lighting will be put in before fall with capacity for furnishing a large number of lights for private and public use. There have been many inquiries from private citizens concerning such lights, and it is not improbable that the railroad company will also require the incandescent lights for inside of stations.

Messrs. Noll Brothers, of New York, well known in the electrical field as contractors for the installation of electric light wires, and dealers in electric light fixtures and supplies, have established a branch office in Boston at the Edison central station, with E. T. Greenfield as manager.

Messrs. Blodgett Brothers & Co., Boston, are busily engaged on large annunciators, several being for hotels at seaside resorts. This firm has received congratulations from many quarters for the creditable wiring work and arrangement of the incandescent lamps for the Boston & Albany Railroad in the several passenger cars lighted by electricity.

The Wainwright Manufacturing Company, 65 and 67 Oliver street, Boston, report shipments of their heaters to the following electric light stations: Wilmington Electric Light Company, Wilmington, Del.; Greenfield Electric Light Company, Greenfield, Mass.; Willimantic Electric Light Company, Willimantic, Conn.; Diamond Illuminating Company, Bar Harbor, Me.; two for the Edison Electric Light Station at Montreal, P. Q., and a large size heater for the Edison plant in Japan.

The Electrical and Industrial Exhibition, held during the past month at Lynn, Mass., closed its doors to the public on June 30. From the beginning to the end the exhibition was a success. Its managers deserve the thanks of the people for the energy, good judgment and impartiality they displayed, and the exhibitors, one and all, are entitled to great credit for the excellence and attractiveness of their respective displays, most conspicuous among which was that of the Thomson-Houston Electric Company.

At a meeting of the officers and committees of the Boston Electric Club at the Parker House, Boston, July 2, Mr. Frank H. Houston, counsel of the New England Telephone & Telegraph Company, was elected one of the four vice-presidents, and Mr. I. E. Elder, N. E. representative of the American Electric Illuminating Company of N. Y., was placed upon the Executive Committee. The Committee on Permanent Headquarters was authorized to lease rooms for the accommodation of the club at No. 66 Boylston street. Books will be opened for the signatures of applicants for membership at the office of Mr. A. H. Chapman, 50 Pearl street, on Wednesday, July 6. The suggestion is not amiss that it would be advisable for those who contemplate joining the Boston Electric Club to come forward and subscribe their names in the membership books at as early a day as convenient.

From Bangor, Me., came the following dispatch, dated June 29: "The annual meeting of the Maine Telegraph Company was held this evening, and the folowing named gentlemen were elected as officers: president, Albert W. Paine; secretary and treasurer, J. T. Ricker; directors, Noah Woods, F. A. Wilson, Charles E. Bliss, Arad Thompson, John F. Colby, Ambrose C Flint, Edwin F. Littlefield and the two others above named.

From the Boston *Commercial Bulletin* I take this: "Mr. Chas. L. Ireson (Boston) has recently fitted up the Citizens' Electric Light Company, of East Boston, with self-adjusting link belt, of which he is the manufacturer and patentee. One matter of great interest to users of belts running at high speed is that an air cushion between belt and pulley is entirely prevented by the use of the self-adjusting link belt, for the reason that the interstices of the belt freely permit all air to escape, thus insuring perfect contact. The belt will convey and deliver power with absolute steadiness, and is not affected by heat or dampness."

The board of aldermen of Newton, Mass., is said to be favorably inclined toward granting a location to the Newton Electric Railway Company for tracks for an electric railway from Newton to Newton Lower Falls and Newtonville to Newton Centre. An officer of the company states that owing to the lateness of the season the track may not be laid before next spring, although it is thought six weeks' time will be sufficient to build the road when all is ready.

The Boston *Evening Herald*, June 30, in an interesting article on electric batteries as a motive power for horse cars, says: "Mr. R. N. Woodworth, of the Julien Electric Company, made a flying visit to Boston to-day to consult with President Whitney, of the West End Land Company, regarding the furnishing of batteries to the West End Company. The Julien system is the one being applied by the John Stephenson Company to a car now in process of building for the West End Land Company, and which will be ready for shipment to this city in about two weeks. The motive power is equal to five horses, and is furnished from storage batteries. The system is the same as that used in Brussels, and the car which was run for the first time in New York last evening will continue in service probably on the Belt line. The Julien Company has already sold to the New England Weston Company some of the batteries, which are applied to a car on the Cambridge horse railroad. The West End Land Company has contracted with the Julien Electric Company for a number of batteries, and some have already been delivered. The first trip of the electric car, which will occur in this city in about two weeks, will be looked forward to with considerable interest by the general public."

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., July 5, 1887.

The work of putting wires underground in this city is being pushed forward more rapidly than ever this season, principally by the electric light companies. All the lighting wires on Broad street from Columbia to Alleghany avenue are now encased in conduits, and Chestnut street has been torn up on both sides for several weeks, preparatory to placing all wires on that thoroughfare beneath the surface, work being carried on night and day.

A dispatch from Washington states that the work of laying 17,000 feet of underground telegraph cable for the use of the district fire alarm and telegraph service has been completed, the work having been done in a remarkably short time. Poles are being taken down rapidly.

A branch of the National Association of Stationary Engineers has been organized in Camden, N. J., by National Deputy H. D. Cozens, of Newark. The officers of the new branch are: President, James Hall; Vice-President, George Downey; Secretary, George Sparks; Treasurer, G. Marshall; Conductor, George Green; Doorkeeper, J. Roberts. The organization will be known as the Camden Association of Stationary Engineers, No. 3, of New Jersey.

The Sharpsburg Electric Light Company, of Sharpsburg, Allegheny County, Pa., was chartered at the State Department last week, with a capital stock of $100,000.

Vickers & Weston, hosiery manufacturers, Kensington, have had their plant increased to 400 lights, with an additional La Roche dynamo for supplying the office with light during the day time; and George Heyser, the West Philadelphia grocer, has had 30 incandescent lights put in, running a La Roche dynamo and a coffee roaster and grinder with a small Baxter engine.

The business of the Samuel R. Linville Company and that of Frank B. Thilow will hereafter be carried on by, and under the name of, Linville & Thilow, Mr. Samuel R. Linville acting as general manager and treasurer, and Mr. Frank B. Thilow as superintendent of construction and electrician. They make a specialty of fitting hotels and residences with all sorts of electrical apparatus, and, with their large force of trained workmen, are achieving a great success. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, July 2, 1887.

The Chicago City Council are dealing with a number of matters of interest to the electrical fraternity. Through the unfailing zeal of Prof. Barrett, city electrician, a number of schemes for lighting and signaling have been brought to the attention of the people The latest one of these is called the "vessel dispatcher" scheme. At a meeting of the Fire and Water Committee the plan was set forth in detail by Prof. Barrett as follows: Build a central station at the tug offices on South Water street, near Franklin, and establish telephone connection with all the bridges on the main branch of the river, on the south branch as far as Twelfth street, and on the north to Chicago avenue. The total number of bridges, including the three railroad bridges under the vessel despatcher's control, would be nineteen. The adoption of this plan will serve to stop the incessant whistling by tugs, and effect a saving of one-fourth of the time now needed for opening and closing the bridges. The estimated cost for the entire plant necessary to operate this scheme is $4,000. The committee recommended the adoption of the plan. This committee sent also to the law department for an ordinance to light the river by electricity. Professor Barrett's scheme is for a plant with 100 arc lights to be operated at a cost of $8,300 a year. He estimates a saving of $1,000 a year from the cost of gas displaced.

The debate upon the telephone license ordinance was resumed in the Council this week and finally the question as to whether the instruments, the poles, or the receipts could be taxed was referred to the Law Department.

I take the following interesting interview from the daily *Times*:

The telegraphic columns of the daily papers announce from time to time the successful introduction of electric railways in the smaller cities of the country. It will possibly be a surprise to most of our citizens to learn that the electric appliances for nearly all of these roads are manufactured in our own city. In order to present to the readers of *The Times* some authoritative data concerning the operating of electric railroads, the Van Depoele Electric Manufacturing Company, of Chicago, was called upon for information. This company occupies the five floors of the large building on Clinton, near Randolph street, as a manufactory, and is evidently crowded to fill orders. Mr. W. A. Stiles, the secretary and treasurer of the company, in reply to a question as to the practicability of running surface and elevated cars by electricity, said:

"The running of street railways by electricity has proven a grand success, and street railways all over the country are contemplating a change from horses to electricity. The Van Depoele Electric Manufacturing Company, of Chicago, has already equipped eight roads, some of which have been running over one year, and all are making money."

"Will you name the cities in which your company have placed electric motors for this purpose?"

"The Capital City Electric Railway Company, of Montgomery, Ala., 13 miles in length; twenty cars, with 8 per cent. grades. The Dix road, Detroit, Mich., 2 miles; two trains of six cars each, 2 per cent. grades. The Appleton Electric railway, Appleton, Wis., 4 miles; five cars, 8 per cent. grades. The Windsor Electric railway, Windsor, Ont., 2 miles; two cars, 2 per cent. grades Scranton Suburban railway, Scranton, Pa., 4 miles; five cars, 7 per cent. grades. Port Huron Electric Railway Company, Port Huron, Mich., 4½ miles; four cars, 3 per cent. grades. Binghamton Electric railway, Binghamton, N. Y., 5 miles; seven cars, 6 per cent. grades. Lima Street Railway Company, Lima, Ohio, 4 miles; three cars, 2 per cent. grades.

"The cars on these roads run from six to twenty miles per hour as desired. In addition to these roads, we are equipping, under the Van Depoele system, electric railways at Ansonia, Conn., St. Catherines, Ont., and Brooklyn, N. Y."

"What is the cost of running street cars by your system as compared with horses?"

"There are over one hundred thousand horses used in handling street cars in the United States—Chicago having nearly nine thousand. Five years is more than the average useful life of a horse for street car purposes. We have thoroughly demonstrated the fact that cars can be run by electricity under the Van Depoele system for one-half the cost of horses, with coal figured on the basis of $6 per ton."

"How would the Van Depoele system work on the proposed elevated railroad on State street, for instance, say from Van Buren street to Hyde Park?"

"It would be simply perfect. The wires carrying the motive power would be placed on the trestle-work or over the top of the cars, and could be used for all purposes, lighting, heating and motive power. There could be no objectionable features whatever, and, as the *Times* said editorially on Thursday, cities that have but a fraction of Chicago's wealth and population easily secure the investment of adequate capital in elevated roads, electric motors and appliances for street transportation adapted to their needs. How much longer must the people of this greatest of Western cities wait for the advent or awakening of enterprise enough to undertake the substitution of modern facilities for the methods of antiquity still employed in the business here?"

There is now no question at all as to the part that electricity will take in connection with railways. The experimental stage has been passed, and nothing now remains but the practical fact of its application.

I learn that Prof. Elisha Gray has consented to deliver a course of lectures upon electricity and magnetism at the Lake Forest University the coming collegiate year. An effort is being made to provide the apparatus necessary for experiment and practical illustration.

I clip the following from a local paper: G. H. Taylor has sold to Robert T. Lincoln for the Western Edison Company the lot 45x188 feet on the south side of Monroe street, 140 feet west of La Salle street, with the five-story building thereon, for $167,000. The purchase is made by the company for the purpose of permanent offices, etc., and store-rooms, and will at once be arranged for that purpose.

Among the orders received by the Western Electric Company the past week are the following: Multiple boards for St. Joseph, Mo., Cleveland, O., Memphis, Copenhagen, Brussels, and additional section for Kansas City, Mo.

Surely the best evidence of the popularity of a concern's goods and their treatment of customers is found in the volume of business done. Such a thought occurred to me while watching the busy scenes presented at the warerooms of the Electrical Supply Company, 171 Randolph street. This company have recently increased largely their already large stock of annunciator bells, wood and bronze push-buttons, etc. They report trade in this line very brisk. The company are the selling agents for the Wirt voltmeter, which is rapidly coming to the front in the opinion of electricians. I notice that it has been preferred to the foreign manufacture in several instances.

Mr. J. H. Reid, agent for the Mather Company, reports that he has closed a contract for a thousand light plant for the Hotel del Coronado, San Diego, Cal. The total capacity will be 1,600 lamps, using four 250 light dynamos.

Mr. A. C. Holand, junior member of the firm of Johnson, Holland & Co., 227 La Salle street, met his death Friday evening July 1st, while connecting up a motor for running a ventilating fan in Lansing & Sickler's restaurant at 124 South Clark street. Mr. Holland was in the service of the telephone company here for several years and was just beginning to reap the fruits of his enterprise in the supply trade. THE ELECTRICAL WORLD in common with his other friends bears testimony to the high estimation in which he was held and the loss felt at his death.

It is a well-known fact that there is a large element of danger in any heavy electric current, but the current is often wrongly blamed. An instance in point occurred recently here, the local papers in large headlines announcing "Another Victim of the Electric Demons," etc. In company with a local electrician I made what inquiry and examination I could, and the circumstances go to show that lightning was the factor in this case. The fatality referred to is the death of a Mr. Mueller, killed at the Washington street station of the Chicago Arc Light and Power Co. The man was standing on a board, which was placed on the top of a coal heap, adjusting a lamp, at a few minutes after noon.

At the very time he was thus engaged a severe thunder shower, accompanied by frequent bolts of lightning, was in progress. Neither the board nor the coal was damp and there were no marks upon his body to indicate the passage of the dynamo current. Shortly after his death, however, a bright red spot appeared over the region of the heart, which (in the opinion of physicians) is caused by a disruption of the blood vessels of the heart such as is caused frequently by lightning. The facts in the case, however, were very meagre. Several points needed in reaching a correct conclusion were wanting, as, for instance, the exact resistance of the lines to ground at the time or shortly after his death.

The Indianapolis City Council has granted a charter to a recently organized street car company to operate a system of street car lines by means of electricity, cables or horse-power. It is understood that several of the stockholders favor electricity, especially as a large saving in equipment and operating expenses would be effected. A letter from the general manager of the company states that he will arrive in Indianapolis in a few days, and work will be at once commenced upon a line from Houghville to Woodruff Place, a distance of about eight miles.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following quotations upon telephone stock:

Bell of Mo.	$155@$157
Central Union	46@ 47
Chicago	385@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	25@ 27
Michigan	76@ 77
Mo. & Kan.	68@ 70
Rocky Mountain Bell	40@ 45
Wisconsin	105@ 107

M.

KANSAS CITY, July 2, 1887.

I am glad to announce the formation of a company in Kansas City to handle the inventions of Mr. Stocker. These inventions were described at some length in my last week's notes. The capital stock is placed at $1,000,000. The charter members include a number of representative business men, and I have no doubt of the ultimate success of the enterprise.

I notice also the incorporation of the "Interstate Electric Company," organized for the purpose of handling electrical supplies in Kansas City, Mo.

COLUMBUS, O., July 2, 1887.

Owing to the enormous increase of the Edison central station business, the F. S. Marr Company have been forced to move their general offices to a more central location than Lewisburg, Pa. Columbus, Ohio, was selected as the point of greatest access, and as having the most available railroad facilities. I find the com-

pany established in comfortable offices in the Wesley Block. In justice to the Marr Company I would say that they deserve great credit for their untiring efforts to push the business, and do only such work as would unquestionably entitle them to the front rank in electrical engineering work in this country. They have lately introduced some very decided and important improvements in the equipment of central stations, which have been devised and perfected by members of their engineering staff, among whom may be counted men of the largest experience and widest repute. In proof of what I have said I would cite only a few of their plants, viz.: St. Paul, Minn., 10,000 lights, New Orleans, La., 8,000 lights, Scranton, Pa., 6,000 lights, and Wilkesbarre, Pa., 5,000 lights.

These plants as well as others constructed by this company, were designed by their engineering department.

The concern is now building central stations at Birmingham, Ala., and La Crosse, Wis., overhead systems; and Columbus, O., and Chicago, Ill., underground systems. In the latter systems Edison tubes are being used for mains and Callender cables for feeders.

The Marr Company confine themselves entirely to the construction of Edison central stations and electric railroads.

THE TELEGRAPH.

Western Union Earnings.—The earnings of the Western Union's test offices for the week ending Saturday, June 25, are given as $187,967, against $171,171 for the corresponding week of 1886, and $158,314 for 1885.

The Telegraph Jubilee.—It has been decided to celebrate the jubilee of the telegraph in England, and a dinner will be given in London, to be presided over by the Postmaster General. The dinner takes place on July 27, the anniversary of Wheatstone's memorable success in 1837.

The Cable Conference.—The Submarine Cable Conference, which has been sitting at Paris, has been brought to a close and the members of the conference are leaving for their several homes. A protocol fixes May 1, 1888, as the time for the convention of March, 1884, to be put in force, with this reservation—that the five signatory states that have not yet voted upon the regulations prescribed in Article V. of the convention shall have adopted such measures as will give effect to this article.

Alleged Wire Cutting.—The following is from the dailies: The inside story of the great crash in stocks last week has not been fully told, but it begins to leak out. It appears now that during the day, Friday, brokers in Boston, Philadelphia, Albany and other large centres were unable to get their orders executed on the New York Stock Exchange. This caused them a great deal of embarrassment, and materially helped to carry out the scheme which Jay Gould has on foot. There is good reason for saying that the reason for all this is that in some way the telegraph wires were tampered with and the orders were held back. By whom this was done it has not yet appeared, but while Jay Gould did not perhaps himself give the order, he was not unaware that this delay was occurring, and certainly not displeased that it should happen so opportunely for his own advantage. It is the talk to-day in Wall street that Jay Gould has now such absolute control of the Stock Exchange that he can do with it about as he will.

THE TELEPHONE.

New Jersey.—Action has been brought at Trenton against the New Jersey Southern Telephone Company for infringement of the Bell patent.

The Banta Telephone.—The American National Telephone Company, incorporated under New York laws, with a capital of $5,000,000, has begun to issue licenses under the Banta patents for telephone service in the United States. The patent was granted last April. It is a method patent, and expressly disclaims the continuous current of Bell, claiming to be able to transmit "vocal or other sounds telephonically by causing intermittent currents of a uniform volume," or, in other words, by a make and break electrical circuit. The instruments are in operation at 26 Broadway. Francis B. Thurber, Edward A. Quintard, William H. Starbuck, Elisha A. Packer, Granville P. Hawes, W. S. Wallace, Walter M. Jackson, J. H. Johnston, H. P. Wells, W. A. Clark, C. H. Botsford, J. H. Schreiner and James W. Banta are the trustees of the company.

The N. T. E. A. Convention.—In his last bulletin, General Barney says: "At the last meeting of this association, held in St. Louis, it was decided that the meeting of 1887 should be held in Pittsburgh, Pa., and that the time of holding the same should be fixed by the Executive Committee. It is probable that the date will be fixed within a few days, so that it may be announced in the next number of the *News Letter*. Undoubtedly some time during the month of September will be selected. The secretary will forward by mail, during the coming week, the blanks calling for information on which to base the usual Report of Statistics. These blanks will be similar in form to those used last year, but the information regarding the time consumed in making 'ten consecutive connections' will not be called for, and the questions regarding the same will be omitted. The circumstances under which these tests are made vary so much in different exchanges that it is not believed that the results obtained are at all valuable for purposes of comparison. This seems to be the opinion of many prominent members of the association."

THE ELECTRIC LIGHT.

Abingdon, Va., is, it is said, to have a Brush plant.

Americus, Ga.—A plant is to be put in by Mr. J. Winslow.

Orlando, Fla.—It is said that Orlando is about to put in a Western Electric plant.

Sumter, S. C.—The Sumter cotton mills propose to put an electric light in their mills.

Electric Headlights.—The National Electric Headlight Company has been incorporated by O. Kinsey, I. Kinsey and E. V. Cherry, at Ludlow, Ky., with a capital stock of $650,000, to manufacture electrical apparatus, etc.

Fairmont, W. Va.—There is a movement to put in an electric light plant. Mr. H. S. Sands is concerned.

Gadsden, Ala.—The Queen City Electric Light Company is about to increase its capacity by 25 lights.

Salem, Mass.—The Salem Electric Light Company has declared a quarterly dividend of 1½ per cent.

Waco, Tex.—An incandescent plant, to be put in by the Southern Electric Light Company, will cost about $10,000.

West Point, Va.—An electric light company has been formed, and will go to work at once. Mr. E. Wilkinson is interested.

Sherman, Tex.—The Sherman Electric Light and Power Company will hereafter do an incandescent as well as arc business.

The Wissahickon Electric Light Company of Philadelphia was incorporated recently with a capital stock of $50,000.

Jamestown, N. Y.—The Jamestown Electric Light and Power Company has been incorporated by M. White, of Boston, Mass., and others.

Buffalo, N. Y.—The Thomson-Houston Electric Light and Power Company has been incorporated with a capital stock of $500,000, by R. K. Noye, G. Urban, Jr., W. W. Sloan, H. C. French and others.

Palmer, Mass.—The Palmer Electric Company, organized recently, has Mr. J. F. Heery and others as incorporators, and a capital stock of $30,000.

Pittsfield, Mass.—The Pittsfield Illuminating Company, to use the Westinghouse system, has been incorporated by W. Stanley, Jr., with a capital stock of $25,000.

Hays City, Kan.—The Hays City Electric Light Company has been organized by H. P. Wilson, H. Oshaut, C. C. Brosius and others with a capital stock of $15,000.

Jerseyville, Ill.—The Jerseyville Electric Light and Power Company has been incorporated by J. G. Schwarz, W. Leigh and W. E. Carlin with a capital stock of $20,000.

North Weymouth, Mass.—A 300-light incandescent plant has been put in at the works of the Bradley Fertilizer Company, under the supervision of Mr. E. F. Woodbury.

Ridley Park, Pa.—The Ridley Electric Light and Power Company, of Ridley Park, Pa., has been incorporated with a capital stock of $10,000. Mr. R. Craven is interested.

Electrical Manufacturing.—The Eastern Electrical Manufacturing Company, Wheatfield, N. Y., has been incorporated by C. C. Gould and others, with a capital stock of $100,000.

Mobile, Ala.—The Mobile Electric Company is busy making preparations to carry out its new contract for lighting the city, and is building a new station and overhauling the old plant.

New York City.—The following are the directors of the United States Illuminating Company for the current year: H. S. Marquand, G. Montague, R. Irvin, Jr., J. Stokes, D. D. Parmly, G. W. Hebard and E. T. Lynch.

The Philadelphia Lighting Company is the name of a new organization, with a capital stock of $3,000,000, incorporated at Camden by T. Cochran, J. O. Potts, C. A. Griscom, H. H. Houston, G. E. Webb, H. P. Linnell and R. H. Baird.

Bennington, Vt.—The Bennington Electric Light and Power Company has been incorporated under Maine law with a capital stock of $30,000. Mr. J. W. Wakefield, of Bath, Me., is President, and Mr. F. A. Sawyer, of Portland, Me., Treasurer.

Austin, Tex.—The Austin Water, Light and Power Company has been incorporated by J. S Drake, C. J. Hildreth, E. D. L. Wicks, L. B. Wicks and others, with a capital stock of $750,000. The company will proceed to put in a plant for incandescent lighting.

New York Subways.—At the last meeting of the New York Board of Electrical Control, of which Mr. J. Hess is now chairman, Mr. F. L. Stetson, of the New York Safety Light and Power Company, made inquiries as to steps to be taken to obtain space in the conduits. The matter will receive due consideration.

Webster, Mass.—The Webster Electric Light Company has just been organized, with a capital stock of $10,000. The president is N. T. Hulburt; Treasurer, Waldo Johnson; Clerk, J. W. Dobby, who are directors with T. T. Johnson and B. B. Murdock. The company starts with a commercial business of $2,000, not including street lighting.

Santa Barbara, Cal.—The Santa Barbara *Press* reports the local electric light company to be busy arranging for the increase in its plant recently voted by the stockholders. The Thomson-Houston system is used, and both kinds of light are in brisk and growing demand. Petroleum is to be used for fuel in the station hereafter, instead of coal.

Lawrence, Mass.—It is stated that the Brush Electric Light Company, of Lawrence, Mass., has passed into the control of the gas company. The new officers are: President—J. R. Simpson; secretary and treasurer—C. J. R. Humphreys; directors—J. R. Simpson, Geo. D. Cabot, J. Fallon, W. Oswald, R. F. McCartney, Geo. Davis, C. J. R. Humphreys.

Manilla, East Indies.—It is stated that an electric lighting company has made a proposal to the municipal authorities to supply Manilla with electric light, the plant including 1000 incandescent and 100 arc lamps. The proposed concession is to last 40 years, the city authorities to grant annually $40,000, and allow 6 per cent. on $145,000, the estimated total cost of the plant.

The Edison Light in Germany.—The German Edison Company in its report, recently issued, states that up to the end of 1886 the company had put up no fewer than 260 installations, including 70,000 incandescent and 1,000 arc lights. The company sold during 1886 90,000 incandescent lamps as against 60,000 in the preceding year, and its outlook for business at the present time is remarkably good.

Erie, Pa.—The Edison Electric Light and Power Co., of Erie, Pa., are pushing their plant to rapid completion. Their building is 120 feet long by 50 feet wide, built of brick and of two stories. They are at present lighting the streets of Erie with the Brush system of arc lights, and are using two Ball engines to drive the dynamos. They have a large gang of men erecting pole lines for the incandescent system, and have just ordered three 13 x 12 Ball engines, coupled together by a continuous shaft to drive the dynamos.

New Edison Stations for New York.—The Edison Company will proceed at once to put up three new central stations in this city, all being uptown. The real estate has already been purchased, and the plans are now being actively carried out. It is proposed that each of the stations shall have a capacity of 30,000 lights, and especial attention will be paid to the motor business. These stations would have been built before, the construction money being in bank for them, but it was wisely decided to await the settlement of the various subway complications.

Factory Pupils.—The Anglo-American Brush Electric Light Corporation of England has decided, it is said, to take one pupil into its works free of premium, the nominations from time to time resting with the City and Guilds Institute, and under the recommendation of Professors Ayrton and Silvanus P. Thompson. It is not unusual to find pupils in American factories, but they would be somewhat surprised if asked, under any circumstances, to pay a premium in return for the opportunities offered to them. Almost from the first they draw a small salary.

The Hill Clutch.—The Minnesota Brush Electric Light Company of Minneapolis, Minn., proposing to erect a large electric plant to have 2,000 h. p. of engines and 28 dynamos of 65 lights each, placed the matter in the hands of a committee of expert mechanical engineers, to decide as to the most desirable arrangement of the plant, and as to the best clutches. The work was largely figured on, but was carried off by the Hill Clutch Works of Cleveland, whose plans were warmly approved, in spite of the fact that the prices were higher than those for the other designs presented.

Rochester, N. Y.—The city authorities of Rochester, N. Y., awarded contracts recently for lighting the streets. The Brush Electric Light Company, 180 lamps, 2,000 candle power, has a contract to run five years, at thirty cents per lamp per night for the first two years; twenty-eight cents for the next two years, and twenty-seven cents for the fifth year; the Rochester Electric Light Company, 100 or more lamps, 2,000 candle power, at twenty-eight and one-half cents per night, contract running five years; the Edison Electric Light Company, 700 or more incandescent lamps, twenty candle-power, at four cents per lamp per night for the first year, four and one-half cents for the second year, and four and three-fourths cents the third year, five and three-fourths cents for the fourth year, six cents for the fifth year.

APPLICATIONS OF POWER.

Bridgeton, N. J., is to have an electric railway.

St. Louis, Mo.—It is reported that an elevated electric railway will be built by H. H. Loughlen.

Galveston, Tex.—The Galveston City Street Railway Company proposes operating its line by electric motors.

Newton, Mass.—The Newton Street Railway Company, operating by electricity, will have eight miles of track and six cars.

The Daft Factory at Jersey City is working at high pressure, the orders in hand for all classes of motors being large and heavy.

Baxter Motors have lately been placed on lighting circuits in New York City, and are reported to be running very satisfactorily.

New South Wales.—It is reported that the Colonial government proposes to introduce into New South Wales a system of electric street railways.

Cleveland, O.—It is reported that a wealthy syndicate has been organized to build an electric road at Cleveland, using the Short-Nesmith system.

The Pittsburgh Electric Motor Company, of Pittsburgh, Pa., has been incorporated by W. McCandless, with a capital stock of $100,000.

Philadelphia, Pa.—The Lehigh Avenue Railway Company has finished six miles of track, and will run this summer. It is probable that electricity will be used.

Clay Centre, Kan.—Five miles of standard gauge track will shortly go into operation at Clay Centre, and it is said that it is likely that electric motors will be used.

South St. Paul, Minn.—The American Rapid Transit Company will, it is said, start immediately two miles of electric railway at South St. Paul, on the Enos system.

Lakeside, O.—Contracts have been made for an electric railway, three miles long, at Lakeside, O., using two cars, and overhead conductors. It will be a summer road.

The Elieson Electric Motor.—The Elieson electric locomotive, in regular operation on the Stratford Manor Park tramway, London, has been hauling passengers at the rate of 7,000 a week.

Carbondale, Pa.—Some time ago we announced that there was talk of an electric railway from Carbondale to Jermyn, about 4 miles. It is now stated that a company has been formed to build a road.

Electric Railway Cars.—It is stated that the John Stephenson Company, Limited, are preparing patterns for cars especially adapted to be propelled by electricity. This new departure is most significant.

Mansfield, O.—The Mansfield Electric Street Railway Company puts its road into operation at once. The track is 4¼ miles long, and uses the Daft overhead system with five cars, the motors being placed under the cars.

Columbus, O.—The Third and Schiller Street Railway Company has obtained its franchise, and will probably begin building at an early date. The capital stock is $75,000. There will be 3½ miles of track. It is proposed to used electric motors.

New York City.—The Twenty-eighth and Twenty-ninth Street Railroad Company has asked for permission to use me-

chanical power. It is chartered for horse power, but it is said that the company is very much inclined to the use of electricity.

The Cleveland Motor Company report an exceedingly brisk business, especially in San Francisco, where the output of their motors already represents a very large horse-power capacity.

Wanted in Russia.—The Sprague Company have been invited to make tenders for supplying a motor plant to be used in digging a new canal in Russia. Eight large motors to drive the excavators, from a central station, will be required.

Dallas, Tex.—The Dallas & Oak Cliff Elevated Railroad Company has been incorporated with a capital stock of $400,000, by T. S. Marsalis, T. Field, J. T. Dargan, J. T. Elliot, W. I. Storms, F. Field, and others. Either electricity or cable will be used.

Immisch Motors.—It will be seen from an announcement made in our advertising columns that the Immisch motor is shortly to be introduced in this country. The motor has a good reputation in England, and has already been illustrated and described in THE ELECTRICAL WORLD.

Wilmington, Del.—The Philadelphia agents of the Sprague Motor Company have closed a contract with the Wilmington Street Railway Company to equip a two-mile extension of the road. Overhead wires will be used, and as in the case of the Richmond road, each car will have two motors, one attached to each axle.

New York City.—A Julien car, full size, equipped with storage cells and twin motors, has been running very successfully for some days past on the Fourth avenue road, making frequent trips from the Grand Central depot at Forty-second street to the Post Office. Mr. Cornelius Vanderbilt and Mr. Chauncey M. Depew have been among the pleased passengers.

The "Industries" Motor Competition.—It will be remembered that our English contemporary *Industries* opened a competition for electric motors. The committee of jurors selected two designs as being the best, namely, those marked "Agir" and "Ironclad." It is now intended to have two motors constructed in accordance with these designs, so that the machines may be put to a practical competitive test.

An English Electric Yacht.—At the Royal Albert Docks, London, the electric yacht "Countess" was launched recently. She has been built for the Electric Locomotive and Power Company, of London. The boat is 90 ft. long, 11 ft. 6 in. beam and 5 ft. 6 in. deep; she will draw about 3 ft. of water. The motive power will be supplied by Elieson storage cells, and the screw will be driven by an Elieson motor, of the pattern which has already been employed with some success for street car traction on the North London tramways.

Running a Big Daily Paper.—A 10 h. p. Sprague motor is now being used to print the Detroit *Daily Tribune*, one of the largest and most enterprising papers in the West. The *Tribune* is, we believe, the first paper in the United States, or in the world for that matter, to be printed on a web-perfecting press using electric power. In the present case the motor is just mounted on the box in which it was shipped to Detroit. The motion is very smooth and uniform, and the work is satisfactory in every respect. We have before us a Sunday 16-page edition of the paper, and find it to compare well for press work excellence with any other sheet of the size. The current for running the motor is furnished by the local Edison Company. At the meeting of the National Electric Light Association in Detroit last year the *Tribune* published very good reports of the meeting, and we now have to congratulate it on its prompt appreciation of the evidence then brought out with regard to the ability of the electric motor to do the work of the press room.

PERSONALS.

Mr. Elmer A. Sperry, the electrician of the Sperry Electric Light, Motor and Car Brake Company, of Chicago, was married in Chicago, June 28, to Miss Lula Goodman of that city.

Mr. Erastus Wiman.—The *Evening Sun* says no name on Staten Island is better known than that of Erastus Wiman, the father of all legitimate sports. His purse is always open, and the latch string of his hospitable house is always on the outside for visiting clubs. His white flannel suit is a familiar sight all over the island.

Capt. O. E. Michaelis, U. S. A., a member of the Council of the American Institute of Electrical Engineers, has recently had the degree of Doctor of Philosophy conferred on him by the University of Michigan. Captain Michaelis has for some time past had charge of the Watervliet Arsenal at Troy, but has now been transferred to Augusta, Me.

Mr. Anthony Reckenzaun, now visiting this country in connection with electric railway work, has been awarded by the Royal Society of Arts its silver medal for his recent admirable paper on electric street cars, read before the Society, and constituting a clear and complete survey of the development of electricity for locomotive purposes in Europe.

Gould Gossip.—Mr. Jay Gould, in an interview, recently published, says he thinks there are just as capable speculators in the street now as ever. He himself is out of it altogether. He does not think the great fortunes of the country will ever be made there. The most money is to be made in the development of railroads. They are the most favorable investments. He remarked: "If you can buy a railroad at 10 cents on the dollar, and by developing it make it worth 100 per cent., you can readily see how money can be made in it." Referring to the increase in the business of the Western Union Telegraph Company, Mr. Gould said he told some of the boys in the office that he would give them each a suit of clothes when the company handled 100,000 messages in a single day in the main office, at Broadway and Dey street. On Monday, June 27, there were 105,000 handled, and he had to pay for five suits of clothes.

MISCELLANEOUS NOTES.

Electric Belts.—The Owen Electric Belt and Appliance Company, of Chicago, Ill., has been incorporated by A. Owen and others.

Fiberite Cells.—Fiberite is a new insulating material made from wood pulp by the Fiberite Manufacturing Company, of Skowhegan, Me. It is now being used for storage cells and by various electrical concerns, and is said to be giving satisfaction generally.

A New Paper.—The *Western Electrician* has made its début in Chicago in a very creditable manner and shape. Its contents are interesting and well edited, and the paper, typography and presswork are all excellent. The venture has much promise of success, and we tender Mr. Kreidler our congratulations on what he has already achieved.

Electric Lighting in Chili.—A commencement has been made at the port of Coquimbo, Chili, in electric lighting, Edison's system being employed. The dynamos, machinery and other plant required for the installation, we learn from *Industries*, have been procured from the United States. Mr. J. Grierson, the British Consul at Coquimbo, thinks that if the experiment proves successful neighboring localities will follow suit.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Carbons.—The business formerly conducted by E. C. Hawks agent, will hereafter be conducted by the United Carbon Companies, office room 90, Wilshire Building, Cleveland, O., who will endeavor to serve the electric light people to the best of their ability at all times. All communications should be addressed as above.

Royal Jubilee Exhibition, Manchester.—The whole of the conducting wires, including mains, branches and leads for the incandescent lighting, and also for the arc lighting of this exhibition, were manufactured and supplied by Messrs. Walter T. Glover & Co., of Salford, Manchester. It may interest our readers to know that the bare weight of the copper alone required for these incandescent lighting conductors exceeds ten tons.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

July 5, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	37
Am. Tel. & Cable	75	77
Cen. & So. Am.	100	110
*Com. Tel	102	103
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	78	80
Pac. & Atl.	48	55
*Postal T. & C.	25	30
South. & Atl.	72	78
W. U. Tel.	76¾	76⅞
W. U. Scrip	75	.....
W. U. Bonds	117	119
Mut. U. Bonds	85	86
TELEPHONE.		
Am. Bell	217	219
Am. Speaking	110	120
Erie	34¼	35
*Hudson River	.....	60

TELEPHONE.	Bid.	Asked.
Mexican	1¼	1¾
*N. Y. & N. J.	87	92
N. Y. & Pa.	.....	.....
New England	45	46
*Southern Bell	125	135
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill.	90	100
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	225	230
*Edison Ill	95	102
*Edison Isolated	.....	.....
*United States	40	50
*U. S. Ill.	90	95
MOTOR.		
*Daft	.....	.....
*Sprague	.....	95

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

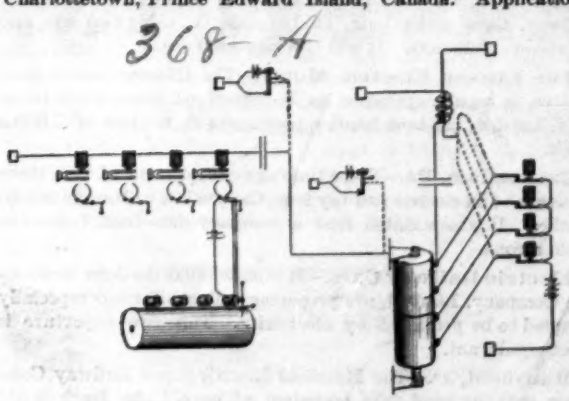
PATENTS DATED JUNE 21, 1887.

Re-issue 10,846. Insulating Material; J. B. Williams, San Francisco, Cal., Assignor to J. L. De Fremery, Oakland, Cal. Application filed May 27, 1887. The compound consists of gutta-percha, india rubber, colophony, gum damar and asphalt, all in solution, and anhydrous paraffine oil with or without powdered silica.

365,040. Electric Valve Mechanism for Water Mains; George B. Bassett, Watertown, N. Y. Application filed Oct. 12, 1886. Devices whereby an electric circuit may be utilized for operating valves.

365,059. Printing Telegraph; S. V. Esick, of Alliance, Ohio. Application filed Sept. 28, 1885. By a new form of commutator, with each alternate impulse the currents on the line are reversed and a more perfect discharge of the line is effected with each impulse. Improvements in the feed and shipping device of the paper carriage are also embraced herein.

365,089. Temperature Alarm System; A. E. Morrison, Charlottetown, Prince Edward Island, Canada. Application



365,103. AUTOMATIC TELEGRAPHY.

filed June 1, 1886. Two circuits run from a thermometer with terminals at different points in the thermometer tube, so that the movements of the mercury will make or break the circuits, causing the operation of an alarm.

365,103. Automatic Telegraphy; C. Selden, of Baltimore, Md., Assignor to himself and W. T. Barnard, of same place, and Francois Van Rysselberghe, of Brussels, Belgium. Application filed Sept. 28, 1886. By the use of resonators properly located with relation to the receiving instrument, one tone out of a number of tones being sent over line is made effective upon a certain instrument, and this instrument being actuated by such tone completes certain local movements which enable certain kinds of work to be performed. See illustration.

365,116. Apparatus for Transforming Electric Currents; L. Bollmann, of Vienna, Austria-Hungary, Assignor of one-half to E. Biedermann and D. Monnier, both of same place. Application filed April 20, 1886. Claim 1. In apparatus for the transformation of electric currents, the combination, with primary and secondary circuits, of a series of closed electro-

365,345. ELECTRIC RAILWAY SIGNAL.

magnets without open poles, a commutator whose plates are connected with the primary and secondary circuits and brushes or contact-pieces connected with the electro-magnets, whereby the coils of the electro-magnets are connected at one period with the primary circuit for charging and at another period with the secondary circuit for discharging. See page 17, this issue.

(1) 365,150. Incandescent Lamp Sockets and Cut-Outs; (2) 365,189. Incandescent Lamp Sockets and Cut-Outs; H. Lemp and M. J. Wightman, of Hartford, Conn. Application filed Aug. 27, 1886. (1) Claim 1. Circuit controlling mechanism for an electric circuit embodying contact blocks carrying circuit completing springs mounted upon an insulating base, a rotary key journaled in one of said blocks, and means for bringing the key in contact with the other block to short circuit the current as the key is rotated. (2) This relates to the key mechanism and the means for securing the key in position in the socket piece. The mechanism is an improvement over No. 1. See illustration.

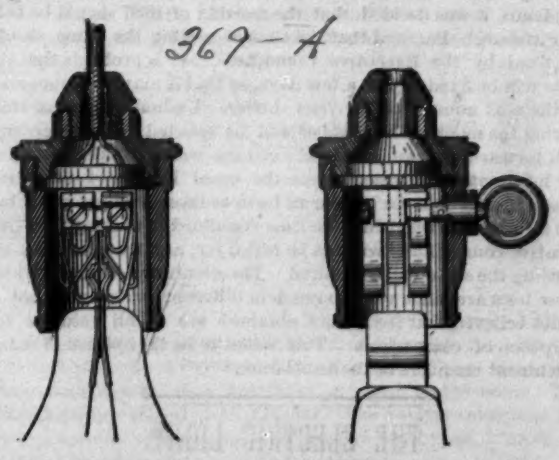
(1) 365,339. Guide Truck for Electric Railways; (2) 365,340. Swivel Truck for Electric Railways; (3) 365,341. Tramway for Electric Railways, with means for insulating the rails; B. F. Hamilton, Boston, Mass., Assignor to the Enos Electric Railway Supply Co., of same place. Applications filed respectively Nov. 11, 1886, Nov. 11, 1886, and March 7, 1887. These inventions all relate to suspended electric railways.

365,345. Electric Railroad Signal; M. W. Long, of Harrisburg, Penn. Application filed Dec. 16, 1885. Mechanism is provided at single track railroad crossings whereby an alarm is sounded on the approach of trains from either direction, but the alarm does not sound after the train passes the crossing or on a train going in the opposite direction. See illustration.

365,353. Coin-Operated Electrical Weighing Scale; W. R. Smith, Bandera, Texas, and A. L. Washburn, New York, Washburn Assignor to Smith. Application filed May 4, 1887. By dropping a coin through a slot in the frame of the device, it will register the weight of any article on the platform.

365,357. Incandescent Electric Lamp; J. Smith, of New Albany, Indiana, Assignor of one-half to J. F. Gebhart, of same place. Application filed Feb. 17, 1887. Means for conveniently switching the lamp into and out of circuit.

365,359. Electric Battery; P. Germain, of Clermont Ferrand, Puy-de-Dôme, France. Application filed Oct. 4, 1886.



365,189. INCANDESCENT LAMP SOCKET AND CUT-OUT.

The absorbent material which holds the electrolyte consists of pulverized cocoanut husks. See page 268, Dec. 4, 1886, for illustrated description.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.